# Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUST PROOFING • LACQUERING & ENAMELING

JANUARY, 1958

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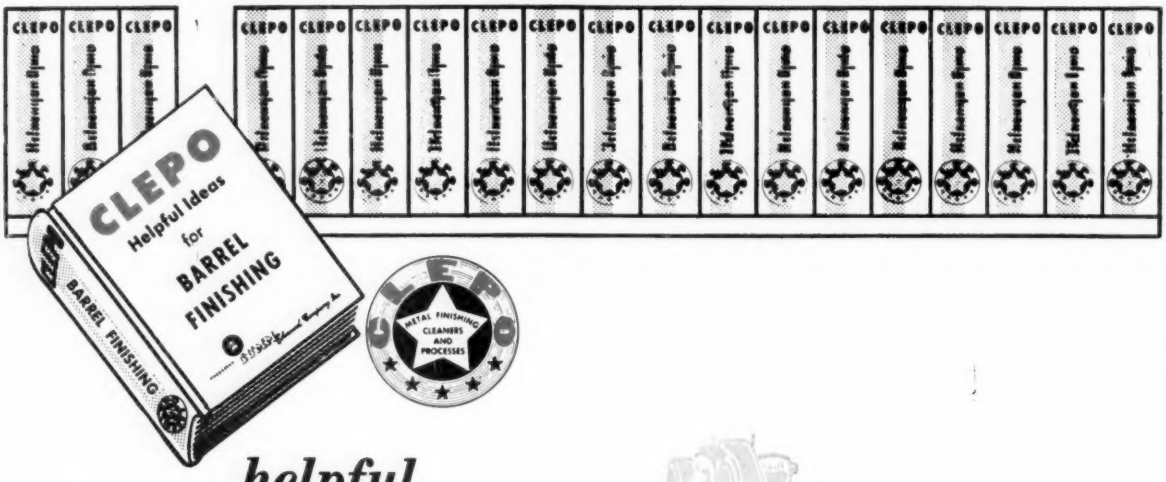
**An Introduction to Wash Primers**
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*Read and pass on—*

LIBRARY OF CLEPO SERVICE




*helpful*

# ideas

*for Barrel Finishing*



Send for a copy of our BARREL FINISHING MANUAL. Here are some of the techniques and materials discussed:

- Self Rolling Operations
- Deburring with Non-Metallic Media
- Deburring with Metallic Media
- Ball Burnishing
- Rolling Media; Tumbling Compounds
- Effective Cleaning Methods and Compounds




Every CLEPO Field Service Man is backed by a technical research and test service with many years of experience in this very work, as well as with cleaning, stripping and similar work.

Plus a detailed discussion of two very effective CLEPO Tumbling Media: Bureens (non-metallic) and Spee-D-Burrs (metallic)

If you have any special barrel finishing problems or are encountering trouble, phone or write to have our field representative in your area call. His broad experience may be helpful. Meanwhile send for the CLEPO Barrel Finishing Manual. It contains a lot of helpful information.

**FREDERICK GUMM**

*Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.




## Which metal do you want to strip?

***There's an Enthone metal stripper for most applications:***

☐ ENSTRIP "S" — an additive for sodium cyanide solutions used to dissolve nickel, copper, gold, silver, zinc, cadmium and alloys of these metals from steel without attacking the base metal in any way.

☐ ENSTRIP "A" —a fully-prepared alkaline mixture already containing sodium cyanide, used for the same purpose as Enstrip "S".

☐ ENSTRIP "Z" —an alkaline stripper that rapidly strips zinc from steel.

☐ ENSTRIP 103 —an economical, alkaline electrolytic stripper for removing nickel, copper, brass, zinc, silver, gold, cadmium, tin and lead from steel.

☐ ENSTRIP CR-5 —a rapid, acid-type dry salt stripper that dissolves heavy deposits of chromium from steel, nickel, copper base alloys, stainless steel and aluminum.

☐ ENSTRIP "T-L" —a fast-acting, dry alkaline stripper for dissolving tin, lead, solder alloys, tin-zinc alloys and zinc from steel base metals.

☐ ENSTRIP 165S — a neutral dry-additive for acid solutions for quick removal of nickel, tin, lead, zinc, cadmium, iron and aluminum from copper and copper base alloys.

☐ ENSTRIP L-88 —a completely prepared acid electrolytic stripper for removing copper, nickel, chromium, brass, bronze, iron and white brass from zinc-base die castings.

These eight outstanding strippers are "stock" items in the Enthone line of chemicals for the metal finishing and electroplating industries. In most cases, one of the "Enstrips" will prove to be the answer to your problem. On the other hand, special developments are available from Enthone to meet requirements not covered by the Enstrips featured above. Write us, outlining your needs, and include a sample of your product, if possible. We'll be glad to recommend the best stripping method possible.

**Write to Dept. MF-1**

DISTRIBUTION AND SERVICE THROUGHOUT THE UNITED STATES, CANADA, MEXICO, BRAZIL AND EUROPE

PRODUCTS OF Enthone THE SCIENTIFIC SOLUTION OF METAL FINISHING PROBLEMS

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INCORPORATED
442 ELM STREET. NEW HAVEN 11, CONN.
Metal Finishing Processes • Electroplating Chemicals

SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

DO YOU NEED BETTER WAYS TO STRIP PAINT?

CAN YOU USE A STRIPPER FOR EPONS?

**When tough finishes resist your present stripping methods, you may need our help.**

| *If your problem is in this column* | *See note below* |
|---|---|
| How to remove epon lacquers, paints and enamels. | A |
| How to strip paint, pigment residues, phosphate coatings, rust and oil in one operation. | B |
| How to strip paint from rejects, conveyor chains, racks and hooks in continuous operation. | B |
| How to strip oil-base paints . . . synthetic enamels . . . alkali-resistant plastics . . . resin-base paints . . . japans . . . wrinkle finishes . . . nitrocellulose lacquers . . . alkyds . . . phenolics . . . ureas | C |
| How to strip zinc chromate primers without etching aluminum. | C |
| How to strip paint from vertical surfaces and undersurfaces where thin-bodied strippers run off without stripping | C |
| How to strip metal parts that are too large to be soaked in tanks. | C |







**FREE** For full information on your problems, ask for:

A—Bulletin B-6530 "*Oakite Stripper S-A*".

B—Booklet "*Here's the best shortcut in the field of organic finishing*".

C—Booklet "*How to STRIP PAINT*".

Write to Oakite Products, Inc., 18 Rector St., New York 6, N. Y.

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OAKITE

Technical Service Representatives in Principal Cities of U. S. and Canada.

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# *For 59 Years* ...L'HOMMEDIEU...

## *year after year has manufactured Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing*



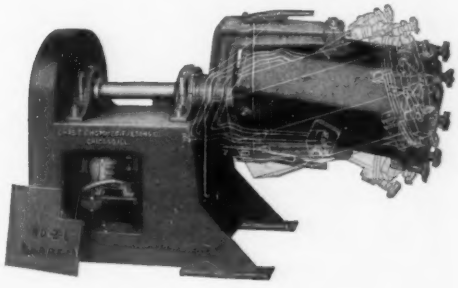

### No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 15 H.P. motors. Adopted by leading manufacturers as standard equipment.

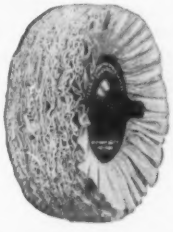
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RELIANCE EXTRUDED COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"

**THEY CUT**
**THEY CLEAN**
**THEY COLOR**

***THE ANSWER TO INCREASED PRODUCTION AT LOWER COSTS***

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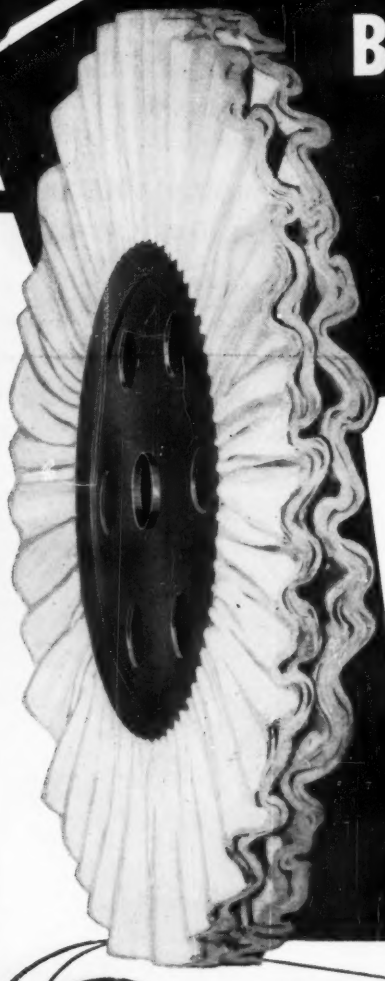
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MADE BY THE MANUFACTURERS OF FAMOUS AND ACCEPTED SCHAFFNER NO NUBBIN BUFFING COMPOSITIONS.

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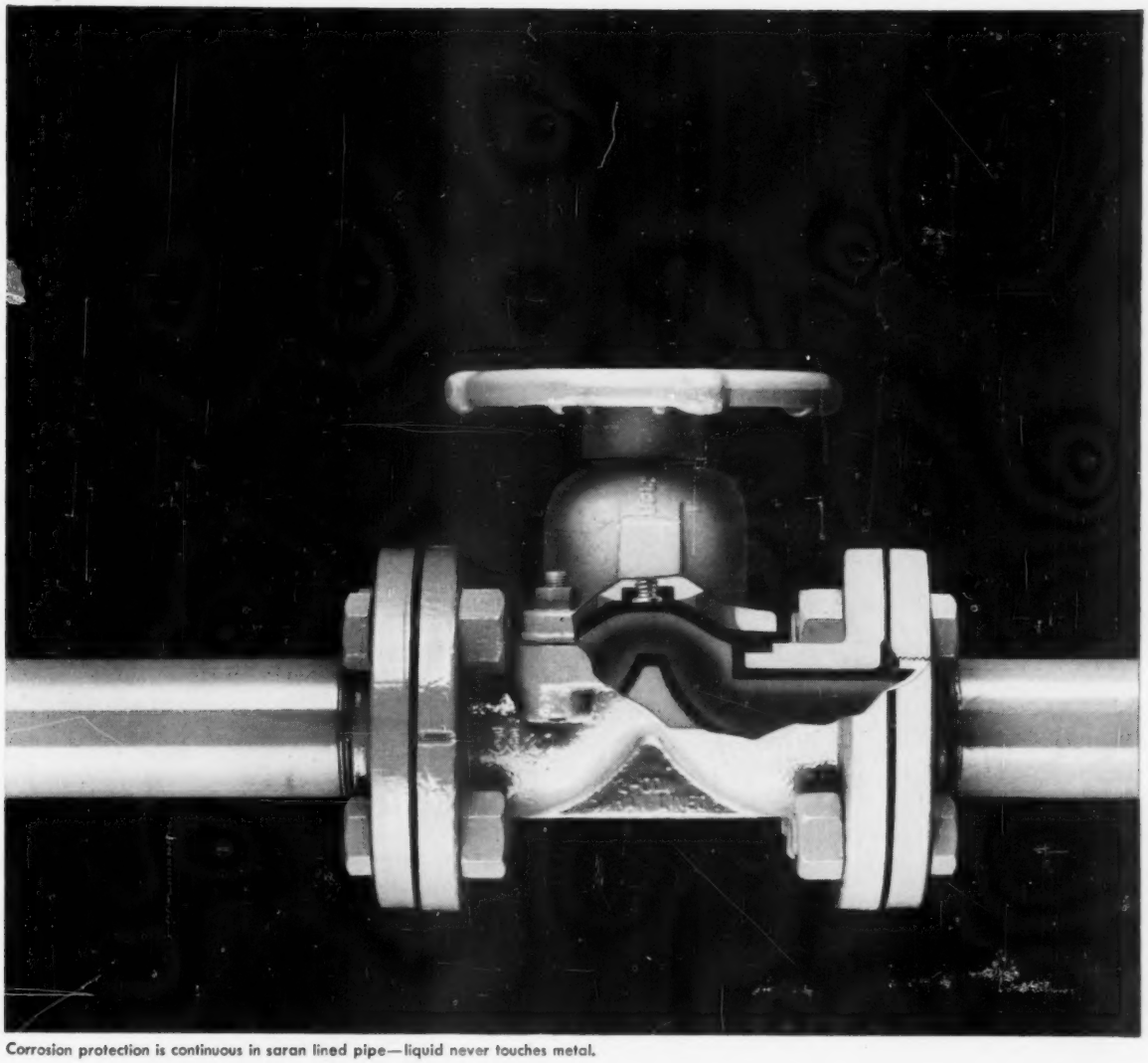

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Corrosion protection is continuous in saran lined pipe—liquid never touches metal.

# Here's why Saran lined pipe offers long range economy

*It's rigid steel pipe . . . lined with corrosion-resistant saran . . . keeps shutdowns to a minimum for years*

Looking ahead? Do your plans call for a complete corrosion-resistant piping system with a low total installation cost . . . a system that requires a minimum of maintenance . . . that's simple to modify . . . that can be fabricated in the field?

Then it will pay you in every way to look into the genuine economy of a complete system of saran lined pipe.

First, consider the natural advantages of the new gray saran lining itself. Its lower coefficient of thermal expansion and contraction more closely approaches that of steel. This provides a broader operating temperature range and greater resistance to thermal cycling. It can be installed in systems with operating pressures from full vacuum to 300 p.s.i. and temperatures up to 200° F. Add to these advantages the immediate availability of saran lined pipe, valves, pumps and fittings and you have an ideal piping system that can be installed without trouble, waiting or hidden costs.

If your plans call for lined tanks, you'll want the advantages of Saraloy® 898 tank lining added to your saran lined pipe system. Get the complete story on how it will pay you to install a complete saran and Saraloy 898 lined system. THE DOW CHEMICAL COMPANY, Midland, Michigan.

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YOU CAN DEPEND ON DOW

# "We switched over to Columbia- so far we've saved $2,100

*says Mr. Bernard Rosebrough*
*Plant Engineering Project Coordinator*
*McCulloch Motors Corporation*
*Los Angeles 45, California*



**"We'd tried four other degreasing solvents,** so I have a real basis for comparison. For example, in the 22 weeks since putting in Columbia-Southern Trichlorethylene, we've cleaned out each of our six units just once. With all the other solvents used, our degreasers needed cleanout and fresh solvent every three weeks. We now make one changeover, instead of eight for the same period. Our net savings on man-hours for maintenance alone, without counting loss of production, adds up to $2,100.

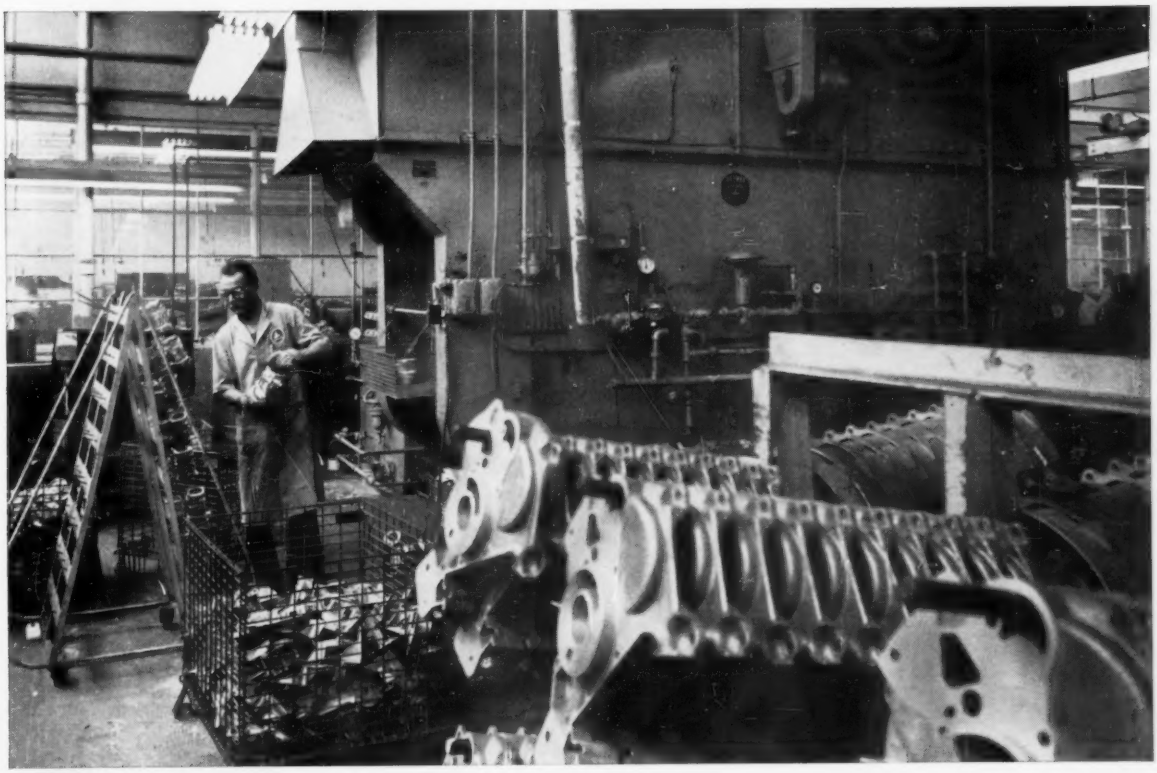


**"Here's the plant,** at 6101 West Century Boulevard. We produce our own line of McCulloch Chain Saws, Scott-Atwater Outboard Motors, Superchargers for custom cars, and four-cylinder drone engines for military target ships.




**"This is the Model 55,** one of our most popular chain saws. We run magnesium, aluminum and steel parts through the degreasers in producing all of our saws and other products. That's one reason why we insist on high solvent uniformity and purity.

# Southern Trichlor 22 weeks ago—just on maintenance alone!"



**"Here's the 'big boy'** of our six degreasing units. It's part of our sub-assembly operation. You can imagine what happens to production when it's shut down for cleanout. Figure two men for 16 hours to do a complete drain, clean, refill—see why I like a solvent that keeps a degreaser like this in action? Another big point. A year ago we had a fire in this unit that caused more than $6,000 damage. We believe that Columbia-Southern Trichlorethylene's stability makes it a safer solvent, and reduces fire hazard to a minimum.

**"Look like I'm sold on one particular solvent?** Well, how about this: Columbia-Southern's Trichlor lets us operate our units ten degrees higher than we felt safe in going with any other solvent tested here. You know what this means: more contaminant saturation, faster cleaning, less solvent used. And I like the dependable delivery and good servicing the jobber and Columbia-Southern's District Sales Office provide."




**For more information, contact our Pittsburgh address or any of the fourteen Columbia-Southern District Sales Offices**

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
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C-10727

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## ...FOR CORROSION INSURANCE!







Long the leading coating for plating racks, Miccrosol has kept pace with corrosion-resistance requirements for other industrial applications.

Famous for its toughness, resilience, abrasion resistance, and flexibility; Miccrosol also has unequalled chemical resistance. Easy to apply and easy to repair; it's available in either *dip* or *spray* formulas.

For the best "corrosion insurance" you can buy . . . use Miccrosol!

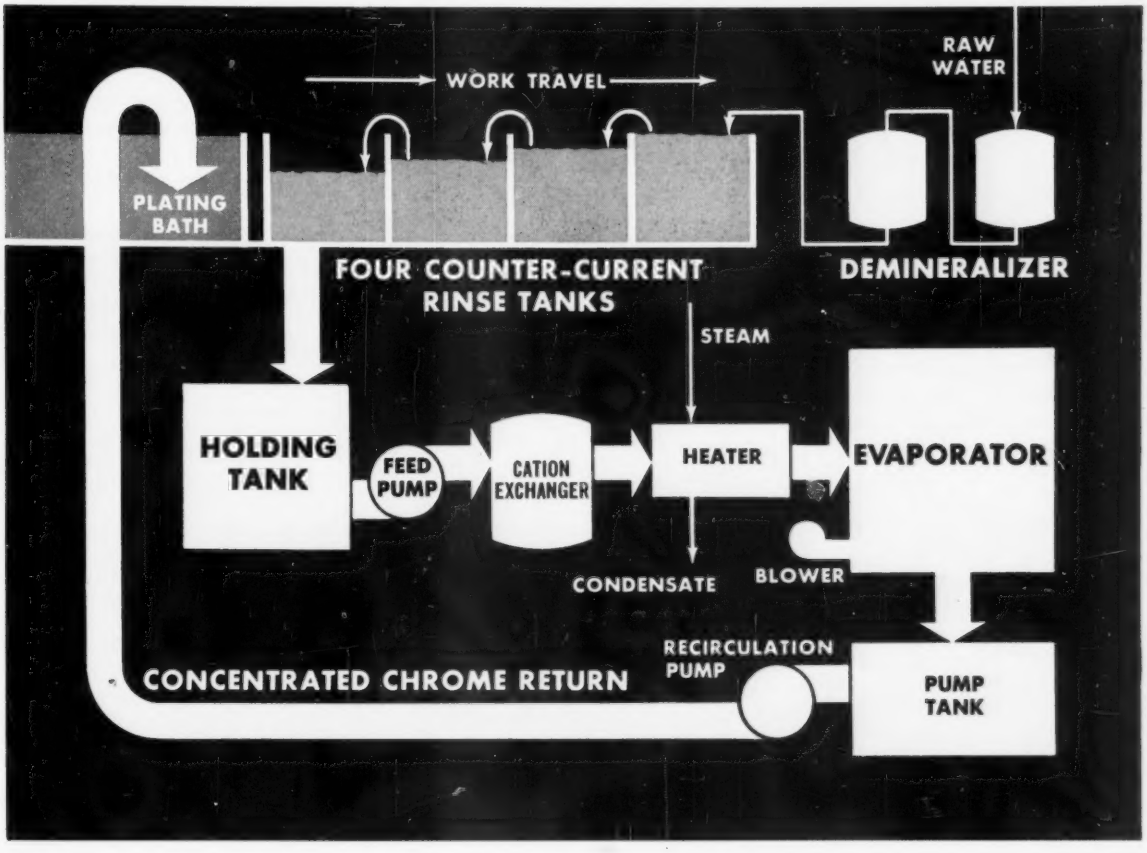
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MICCRO Products

*Developed and manufactured by experienced platers and coaters*

FOR TANKS, DUCTS, AND OTHER EQUIPMENT




# Chromium recovery costs less than destruction!

Designed for a large auto manufacturer, this Industrial Chromic Acid Recovery System was carefully analyzed for operating costs, including labor, power and amortization. When compared with a destruction system of equal capacity, ***Industrial's system shows a net daily GAIN of $26.65 against destruction COSTS OF $54.06****

## How Industrial engineered the system

After a thorough analysis of the entire plating operation, Industrial engineers recommended that the rinse water flow rate be reduced. When this was done, rinsing was still efficient and complete with less than 4 ppm acid concentration in the final tank . . . but the higher concentration in the first tank made it possible to use a fast, convenient evaporator to recover chromic acid. No pre-concentration was needed (the small cation exchanger only removed metal contaminants). Industrial then planned and built the entire system including tanks and pumps.

**We hope you noticed the key words . . .** "thorough analysis" in the paragraph above. This is typical Industrial engineering—and at the auto plant it led to truly impressive gains in plating efficiency and economy. Why not use this kind of service yourself... ***To solve your plating problems call Industrial*** . . . and work with the men most experienced in the industry at handling plating solutions—all along the line.

*See article "Profitable Recovery of Plating Wastes by Reconcentration of Reduced Volume Rinses"—Odlund & Hesler. Plating, August, 1956. Reprints are available of this paper by two Industrial engineers.

***Send for complete data . . .***

**INDUSTRIAL**

**FILTER & PUMP MFG. COMPANY**
5906 OGDEN AVENUE • CHICAGO 50, ILL.

**Please send me literature and reprints of articles on plating waste disposal.**

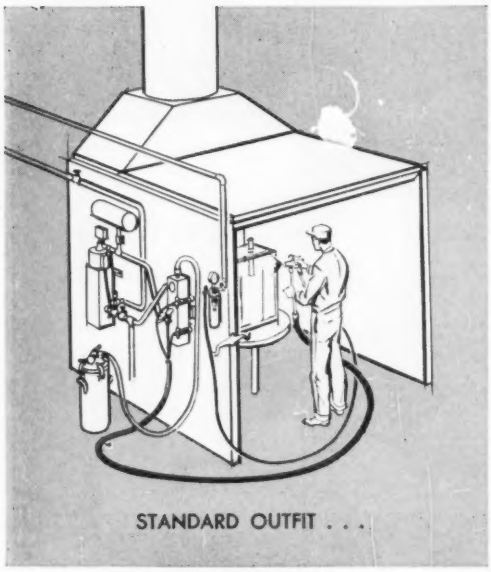
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COMPANY_____

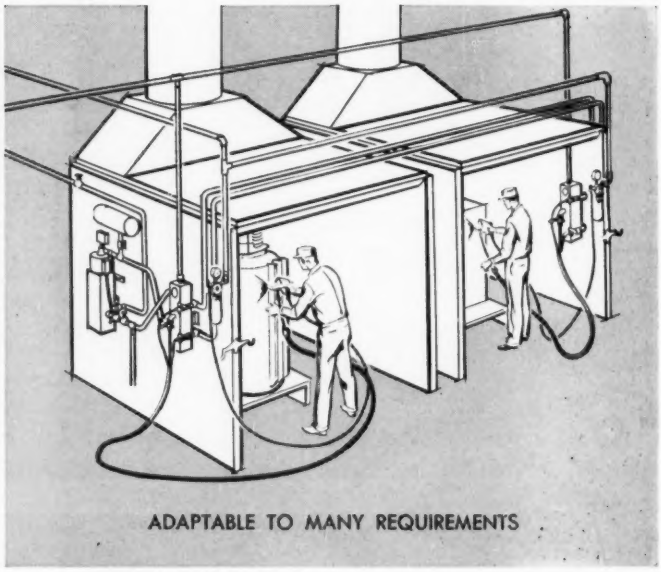
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# How DeVilbiss Hot Spray cuts painting costs



STANDARD OUTFIT . . .



ADAPTABLE TO MANY REQUIREMENTS

**Heavier film builds • Less overspray**
**Faster drying • Easier application**
**Fewer rejects**
**Better flow-out for high gloss**

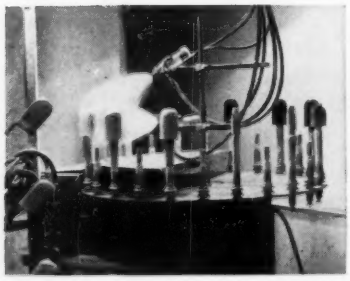
DEVILBISS NEWCOMB-DETROIT

Using a DeVilbiss Paint Heater, you can get better coverage with *one* coat than you generally get with *two or more* cold-sprayed coats!

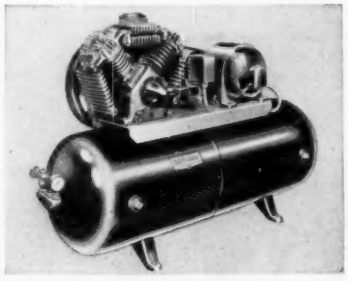
Here's why: Heat acts as a thinner to permit easier atomization and brings about new efficiency in spray painting. Even with your regular paint, heavier finishes can be applied with a savings of up to 50% in materials.

What's more, thinners are vaporized faster, drying time is decreased, finishes flow smoother and with less shrinkage. And the lower spraying pressure greatly reduces wasteful overspray.

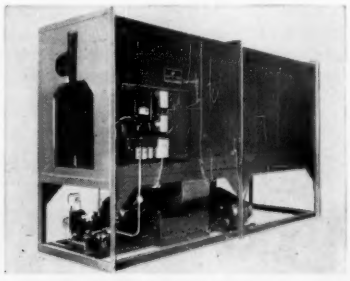
Call our nearest branch today, or write for free booklet, "New Efficiency from Hot Spray." The DeVilbiss Company, Toledo 1, Ohio.



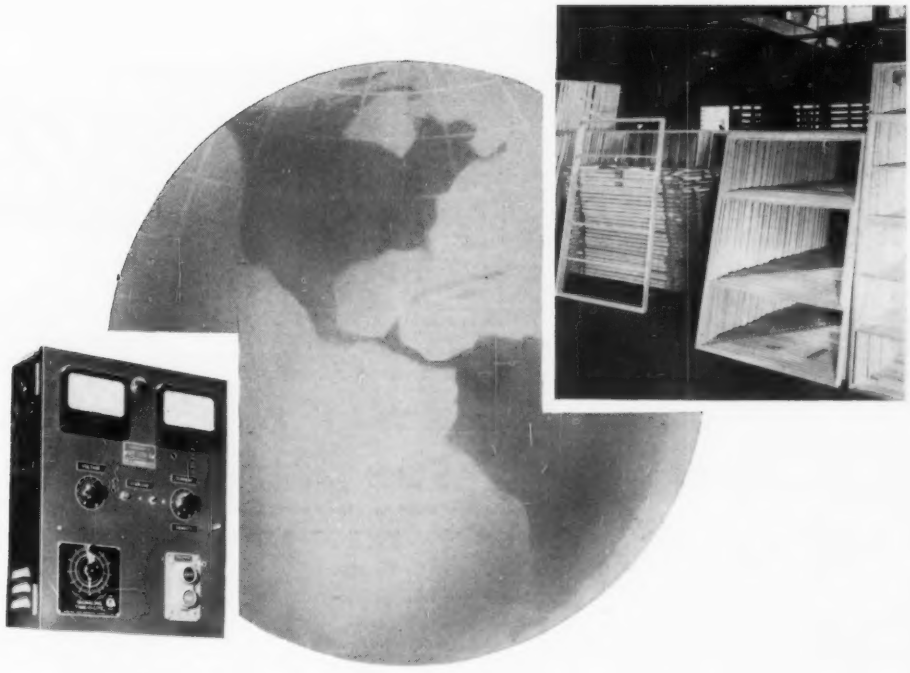
**DeVilbiss Automatic Spray Machines** coat products of any size or shape quickly, economically, automatically.
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**DeVilbiss Air Compressors** deliver as much as 22.6% more air per power dollar. Sizes range from ½ to 15 hp.
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**Newcomb-Detroit Ovens** are designed and manufactured to meet layout and process needs for baking or drying.
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*"There's a world of difference in Anodizing when you have Automatic Current Density Control" . . .*

*. . . says John Gurniak of*

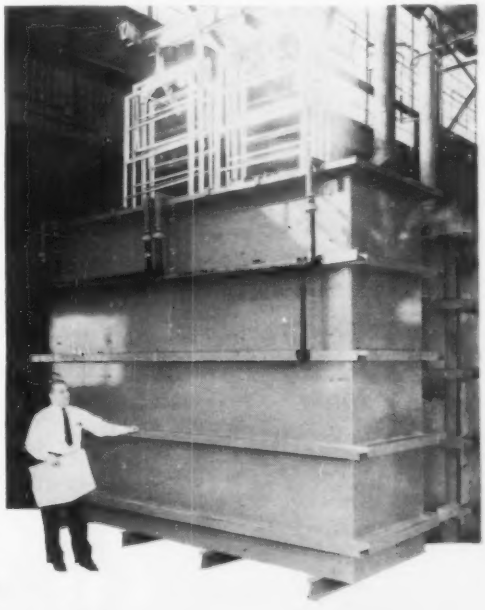
*MICHAEL FLYNN MFG. CO., PA.*

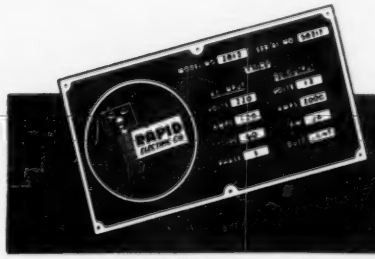
*"and that big difference is the accuracy and simplicity in which a pre-determined film thickness can be controlled."*

*"We chose RAPID ELECTRIC'S Automatic Current Density Control rectifiers to eliminate the problem of estimating current densities with each load change. One setting, and the rectifier automatically maintains a constant current density per square foot of work."*

*"It's that easy".*

*"Once more, with the possibility of over-current virtually eliminated, MICHAEL FLYNN'S high standard of quality is assured."*





THE NAMEPLATE THAT MEANS *"More Power to You!"*

**RAPID ELECTRIC COMPANY**

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a completely new plating development . . .

# ARcoRAX PLATING RACKS!

## Now — a plating rack that answers the production problems vital to the plating industry . . .

ELIMINATES HIGH MAINTENANCE COSTS

REDUCES DRAG-OUT LOSSES

REDUCES METAL BUILD-UP

REDUCES DOWN-TIME TO MINUTES

CUTS PRODUCT REJECTS

NO DRAG-IN SOLUTION CONTAMINATION

REMOVABLE CONTACT TIPS

SELF SEALING JOINTS

COMPLETELY PROTECTED WITH MOLDED COATING

SMALL INVENTORY OF PARTS

EASY ASSEMBLY FOR PRODUCTION CHANGE-OVER

Write for Information and Demonstration

**CHECK THESE FEATURES AND BENEFITS . . .**

| Features | Benefits |
|---|---|
| MOLDED COATING—Vulcanized to metal | No pockets—eliminates drag-out losses, minimum thickness ⅛" at all points. Greater thickness on edges and corners. |
| NON-CONDUCTIVE—No carbon filler in coating | Will not plate through on the rack. |
| ELASTIC, FLEXIBLE—60 durometer coating | Resilient, coating will not crack or soften. Permits machining and forming after mold. Molded pieces can be joined by bolting with a complete seal at inner faces of joints. |
| CHEMICAL RESISTANCE OF COATING | Coating compound lasts for several years. |
| RACK LIFE | Rack life up to several years. |
| RACK REPAIR | Adaptor tension members can be replaced in minutes on the plating conveyor. |
| ASSEMBLY—Rack, adaptors, tips | Tips with build-up plate can be removed and replaced on the line. Rack can be re-used for new parts by designing new adaptors cutting new rack costs approximately in half. |
| COPPER CONSTRUCTION—Oversize, heavy duty copper | Rugged, carries proper current to all parts. |
| INTEGRAL HANGER HOOKS—No current resistance | No bolted or other resistance joints between hanger and adaptors. |

● Amazing in performance . . . outstanding for durability and long life. . . . ARcoRAX Plating Racks coated with a new blended thermosetting compound developed in ARco laboratories, is vulcanized to the metal with complete adhesion and is resistant to plating cycle chemicals including chromic acid.

Versatility and simplicity of design . . . ARcoRAX Plating Racks keep your plating production at full capacity at all times. Let ARco Engineers review your plating problems.




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*Plating Equipment Division*

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2. BOLTS DERUSTED WITH HYDROCHLORIC ACID SOLUTION AND LEFT STANDING OVERNIGHT



3. BOLTS DERUSTED WITH HOT CAUSTIC SODA SOLUTION AND LEFT STANDING OVERNIGHT



4. BOLTS DERUSTED WITH HOT CAUSTIC SODA-GLUCONATE SOLUTION AND LEFT STANDING OVERNIGHT



the case for

# alkaline rust removal

## when caustic solution efficiency is increased with Pfizer Gluconic Acid or Sodium Gluconate

● If you now remove rust from metal with an acid bath, you are well aware of the major disadvantages involved—hydrogen embrittlement and metal loss caused by corrosive action of the acid.

While alkaline rust removal helps solve these problems, it has, in the past, seldom been considered a practical or efficient method for production line metal finishing.

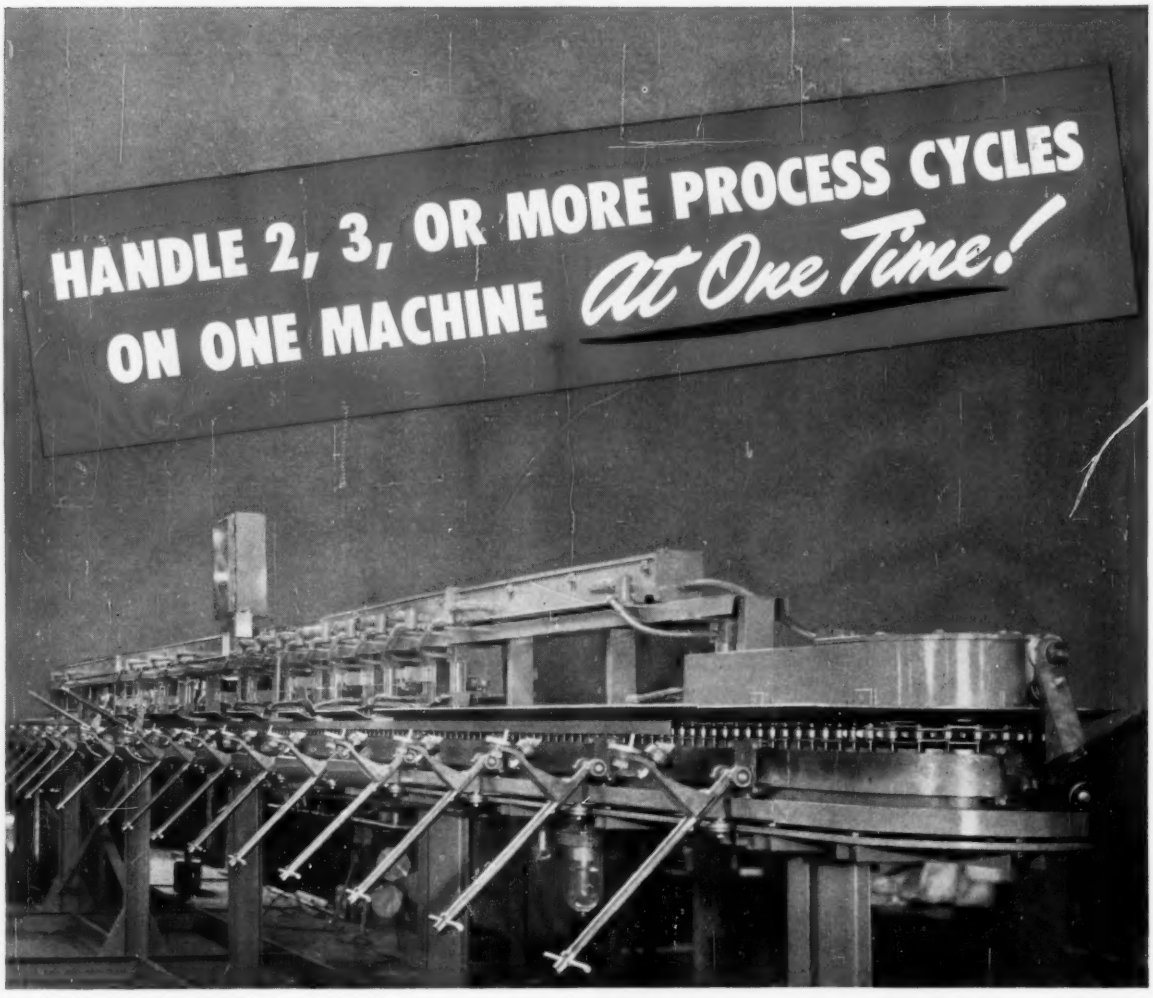
*Now, however, fast alkaline rust removal and paint stripping are possible by the addition of Pfizer Gluconic Acid or Sodium Gluconate to caustic solutions.* In a caustic solution, gluconic acid or sodium gluconate prevents insoluble metals from precipitating, increases efficiency of the rust removal or paint stripping, and prolongs the life of the bath.

Why not test the effectiveness of a caustic-gluconate bath in your metal finishing? See for yourself how fast action and low corrosion rates can be combined through the use of Pfizer Gluconic Acid or Sodium Gluconate in caustic baths. If you would like further technical data on this subject, write to Pfizer today.

*Manufacturing Chemists for Over 100 Years*

Pfizer

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Branch Offices:
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# LASALCO'S *Select-O-Matic*

## MULTIPLE PROCESS PLATER

Another Lasalco development that offers the industry the last word in *fully automatic* plating!

With the new Select-O-Matic, the operator simply selects the desired process cycle for individual racks, when loading the machine, merely by turning a dial on the carrier. From that point, the rack *automatically* travels through the entire selected cycle without further attention.

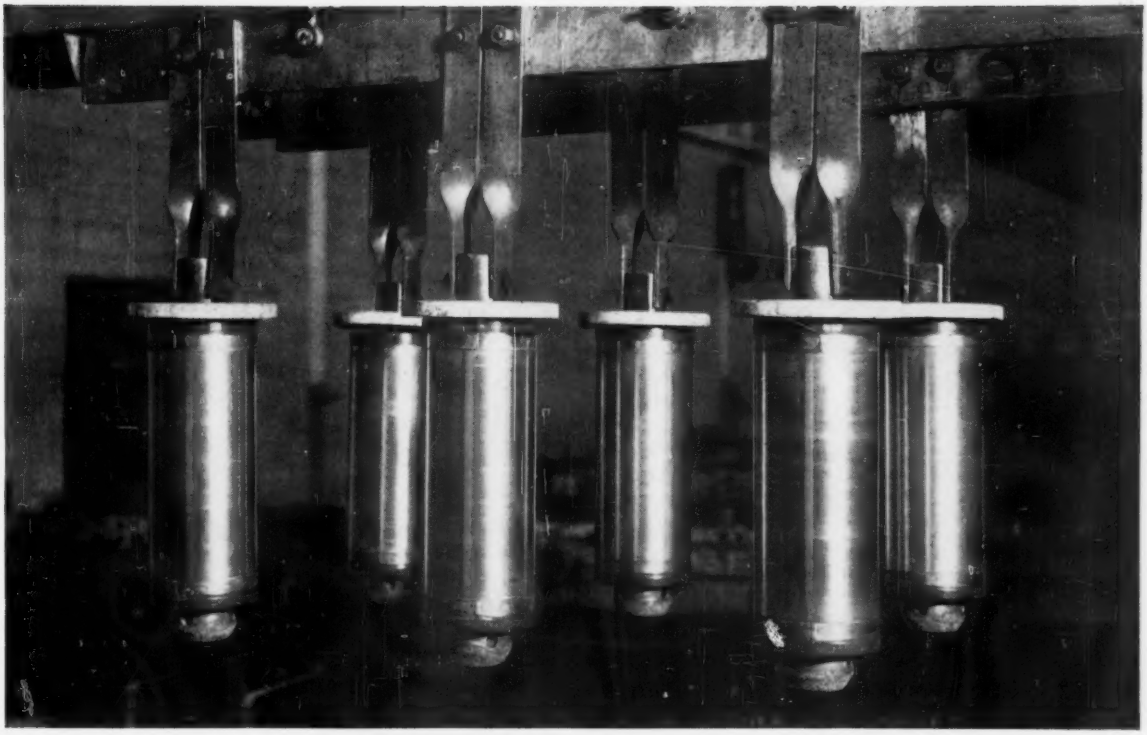
A single Select-O-Matic plater, manned by one operator, will handle several various processes simultaneously. Different machines for each process are eliminated—original investment in equipment is greatly reduced—much less floor space is needed—maintenance is cut to an absolute minimum.

The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about *your* operation and requirements to learn what this new machine can do for *your* production and profits.

***Write Today!***

## LASALCO, INC.

**HOME OFFICE: 2820 LaSalle St. • St. Louis 4, Mo. • PRospect 1-2990**
**IN TEXAS: 2805 Allen Street • Dallas, Texas • Riverside 7-5814**



These six arbors of piston rings have just emerged from a chrome plating bath at the Koppers Company's Baltimore plant. Consistently low sulfate content of Mutual Chromic Acid helps insure flawless finish on critical parts like these.

## To insure a uniform, flawless chrome finish use

# MUTUAL *LOW SULFATE* CHROMIC ACID

When chrome plating must be perfect – when anything less means a profit-eating reject – you can rely on Mutual Chromic Acid to reinforce your technical skill.

Mutual Chromic Acid is always 99.75% pure – or better. Sulfate content never exceeds 0.1%. This consistently low sulfate content of Mutual Chromic Acid makes it easy for you to control the acid-sulfate ratio of your plating bath. It is your insurance against plating difficulties.

Send today for the free Mutual booklet, "Chromium Chemicals," which contains useful technical information about the entire line of Mutual chromium chemicals. A Technical Service Staff is also available, to offer help or information at any time.

Mutual Chromium Chemicals

MUTUAL

Sodium Bichromate
Sodium Chromate
Chromic Acid
Potassium Bichromate
Potassium Chromate
Ammonium Bichromate
Koreon (One-Bath Chrome Tan)

MUTUAL CHROMIUM CHEMICALS
SOLVAY PROCESS DIVISION
Allied Chemical & Dye Corporation
61 Broadway, New York 6, N. Y.

Allied Chemical

Please send me Bulletin #52–Chromium Chemicals–Their History, Properties and Uses.

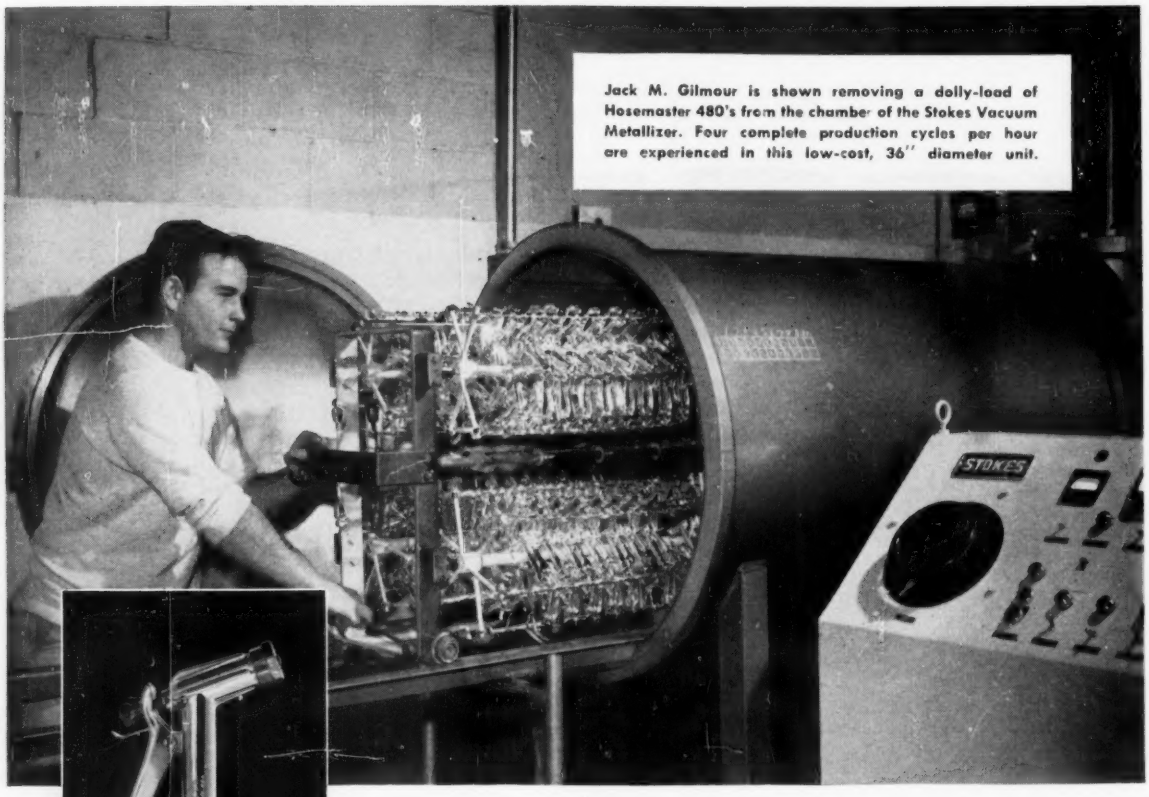
NAME_____ POSITION_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

P-3-7-1




Jack M. Gilmour is shown removing a dolly-load of Hosemaster 480's from the chamber of the Stokes Vacuum Metallizer. Four complete production cycles per hour are experienced in this low-cost, 36" diameter unit.



# Gilmour Hosemasters given lasting finish in Stokes Vacuum Plating Chamber

Gilmour Manufacturing Co., Somerset, Pennsylvania, is the world's largest maker of pistol-grip hose nozzles—the Hosemaster line. Their Model 480, for example, is leak-proof and clog-proof, with a tooled all-brass valve arrangement . . . has a lifetime metallic finish on the body, put there in a Stokes Vacuum Plating Chamber.

Vacuum metallizing can give a distinctive gold, brass, copper or chrome finish at a cost considerably lower than electroplating . . . making it possible to offer smart, modern tools at low, competitive prices. It also enables plating of non-conductive materials . . . and bright lasting finishes that must withstand weather and other abusive environments.

Interlocked centralized controls on the Stokes systems make it easy for employees to learn operating procedures and routine—and to produce consistently high standards with minimum labor. The equipment, itself, is compact and self-contained . . . requires little floor space.

Investigate this modern, low-cost method for finishing metals or plastics. Stokes can give you practical help in over-all planning . . . to determine plant layout as well as production techniques, rates and costs . . . to select materials and auxiliary equipment . . . to train your operators. Contact your nearest Stokes office, or write for additional data on Stokes Vacuum Metallizing equipment.

*Vacuum Equipment Division*
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

**STOKES**

# HARSHAW NICKEL CHEMICALS *For Many Uses*

**NICKEL ACETATE**

*Uses:* Hydrogenation Catalyst
Dye fixative on colored anodized aluminum

High Purity

Crystals (Granulated Sugar Size)

Packaged in 100 lb. Fiberpak Drum with Polyethylene Liner

**NICKEL CARBONATE**

*Use:* Electroplating

High Purity

Light, Fluffy Powder

Packaged in 50 lb. Multiwall Bag

**NICKEL CARBONATE HYDROGENATION**

*Uses:* Source of catalytic nickel for hydrogenation of: Vegetable oils, petroleum products, organic chemicals

High Purity

Fine Powder

Packaged in 55 gallon drum —125 lbs. net

**NICKEL CATALYSTS**

A complete line for Hydrogenation, Methanation, Gas Reforming, Desulfurization, Reduction and many other reactions

**NICKEL CHLORIDE**

*Use:* Electroplating; Source of Catalytic Nickel

High Purity

Crystalline

Packaged in 100 lb. Creped Kraft Bag with Polyethylene Liner

**NICKEL FLUOBORATE**

*Use:* Nickel plating

High Purity

Green liquid

Packaged in Returnable Drums —150 lbs. net; non-returnable steel pails with Polyethylene Film Liner—55 lbs. net.

**NICKEL FORMATE—**
**High Grade Uniform Product**

*Uses:* Source of catalytic nickel for hydrogenation of oils, fats, fatty acids, and organic compounds. Used in some plating solutions

Green Crystal

Packaged in Burlap bag with Polyethylene Liner—100 lbs. net

**READILY AVAILABLE HIGH QUALITY**

*Contact the Harshaw branch nearest you for more information or for prompt attention to your order*

HARSHAW

**THE HARSHAW CHEMICAL CO.**

1945 East 97th Street • Cleveland 6, Ohio

CHICAGO, ILLINOIS
CINCINNATI, OHIO
CLEVELAND, OHIO
DETROIT, MICHIGAN
HOUSTON, TEXAS
LOS ANGELES, CALIF.
PHILADELPHIA, PENNA.
PITTSBURGH, PENNA.
HASTINGS-ON-HUDSON, NEW YORK

**NICKEL NITRATE**
**(Purified or Regular)**

*Uses:* Source of Catalytic Nickel; Nickel plating solutions

Crystal

Purified packaged in 44 gallon Fiberpak Drum or Polyethylene lined barrel—400 lbs. net

Regular packaged in 44 gallon Fiberpak Drum—400 lbs. net; or 55 gallon drums —500 lbs. net

**NICKEL OXIDE**
**(Black, Green)**

*Uses:* Ferrite cores (Green), Ground coat frits, glass batch and ceramic glaze colorant, ceramic colors

Black—fine, dense black powder; Green—air floated powder

Black packaged in drums—350, 100, 25 lbs. net

Green packaged in drums—250, 100, 25 lbs. net

**NICKEL OXIDE, GREY**

*Uses:* Source of nickel for catalyst use

Free-flowing blue-grey powder

Packaged in drums—300, 100, 25 lbs. net

**NICKEL SULFATE**
**SINGLE NICKEL SALTS**

*Use:* Nickel plating; Source of Catalytic Nickel

High Purity

Small Crystals—$NiSO_4.6H_2O$ (Size meets screen specification of thru 4 on 35 mesh.)

Free Flowing—Rapid Solubility

Packaged in new 100 lb. Creped Kraft Bags

SIEFEN STAINLESS STEEL COMPOUNDS

CUT • CUT AND COLOR • COLOR

SIEFEN TRIPOLI COMPOUNDS

CUT • CUT AND COLOR • COLOR

## SIEFEN
## STAINLESS STEEL COMPOUNDS

The J. J. Siefen Co. has the correct liquid stainless steel compounds for all ferrous metals

For Use on Tampico Wheels

To Produce Stain Finishes

For Use on Sisal Buffs

For Fast Cut on Cold Rolled Steel

For Cut & Color on Stainless Steel

For Use on Loose Muslin or Linen Buffs for Color

## SIEFEN
## TRIPOLI COMPOUNDS

Siefen's liquid "Tripoli" Buffing Compounds are used on all Non-Ferrous Metals.

Buffing Copper-Plated Automotive Parts, Zinc Die-Cast Hardware and Automotive Parts, Aluminum Kitchen Utensils and Automotive Parts, Brass Escutcheons, Plastic Handles for Cutlery.

*Happy and Prosperous New Year!*

J. J. Siefen CO.

5657 LAUDERDALE DETROIT 9, MICH.






## Udylite Machine and Process combine to set new Scripto standards

The Udylite Cyclemaster provides the accuracy and steady flow of production. Udylite Bright Nickel furnishes the sparkling finish. Together they solve for Scripto, of Atlanta, Georgia, the knotty problem of better finish of the Scripto pens, pencils and cigarette lighters.

Scripto's first bright nickel was the Udylite #31 process. It was superseded by the Udylite #514 process to gain the faster brightening which is so important in nickel plating to a high luster with a thin coat.

The adoption of Udylite Bright Nickel Process #724 was the next step as it offered still faster brightening and even more important all the time saving advantages of all liquid brighteners.

Step by step Scripto has lowered costs and improved quality with Udylite Processes and Precision Automatic Plating. Here is just one of many examples of the right application of process and equipment. Out of the line of Udylite products can come the answer to your problem as well.

Contact your local Udylite Sales Representative . . . let him show you how the *right* combination of Udylite processes and machines can improve your quality and production.

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER

# Look to . . .

## Wyandotte for lower metal-finishing costs, complete service

Wyandotte offers you the complete line of cost-cutting industrial chemical products to improve the quality of your metal-finishing operations.

In addition, Wyandotte provides prompt, accurate, and thorough technical service through trained representatives. This service, together with warehouse stocks, is available from coast to coast.

We can accurately **survey** and **analyze** all your specialized chemical-finishing operations. Let us help you — no obligation. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

### Wyandotte's complete line of products for metal finishing:

★ **Buffing Compound Removers.** MERSOCLEAN-540 process for all metals.

★ **Electrocleaners.** Anodic and Cathodic—for steel, copper, brass, zinc die castings, nickel, and other metals: F.S.,* B.N., C.S.R.,* LECTRITE-NF.

★ **Soak Cleaners.** Complete line for the electroplating, vitreous enameling, and painting industries: W.L.G.,* ALTREX,* NO. 11 CLEANER, RUVAT.

★ **Barrel-Finishing Compounds.** De-burring and burnishing types for steel, stainless steel, brass, zinc die castings, aluminum, and copper.

★ **Washing-Machine Cleaners.** Alkaline and emulsion types, for spray and rotary machines: EXPRAY-AP, INDUSTRIAL 38, NORDALL,* EMLON.*

★ **Paint Removers.** Alkaline and solvent types, for all finishes on all metals.

★ **Paint-Preparation Products.** Cleaning and phosphating processes: PRE-FOS,* PHOS-IT.*

★ **Paint-Department Maintenance.** Water-wash compounds, dry-wall compounds, booth-cleanout compounds.

★ **Rust and Scale Removers.**

★ **Aluminum-Specialty Products.** Etchants, de-smutting compounds, preparation for spot welding, brighteners.

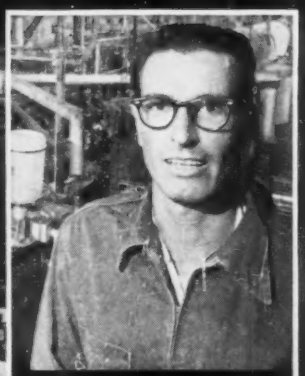
★ **Rust Preventatives.** R-2, NORDALL.*

★ **Neutralizers.** For pickling and vitreous-enameling lines.

*Reg. U.S. Pat. Off.

"The Best in Chemical Products for Metal Finishing"

"THIS STEVENS MACHINE LOWERED OUR PLATING COST BY 30%" says



MR. J. A. WEAVER
PLANT SUPERINTENDENT
HILL PLATING CO.
LONG BEACH, CALIF.



## "...and *tripled* our man-hour production rate!"

The Hill Plating Company has discovered that their installation of a STEVENS "Little Steve" Automatic Plating Machine, has not only done away with the usual problems of hand line operating...

IT HAS ALSO . . .

- Lowered unit costs
- Met all production requirements with ease
- Released workers for other inter-plant tasks
- Saved up to 50% in plating solutions

*And*, along with these economical developments, the Hill Plating Company is now enjoying the even balance of production and labor that *only* accompanies automatic plating!

If your present method of plating is keeping your processing costs up, why not let your local STEVENS Sales Representative show you the *profitable* way to increase production!

Remember — When you go automatic . . . go STEVENS!

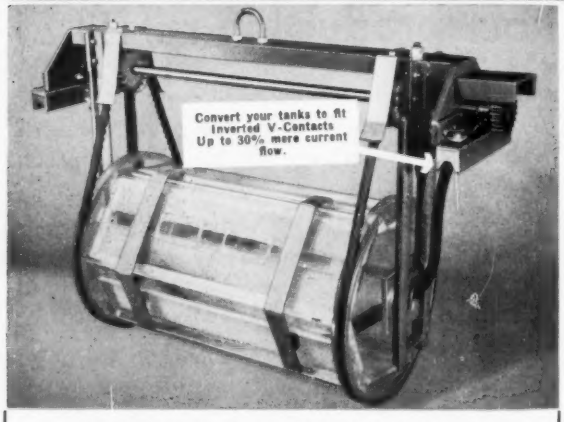
frederic b. **STEVENS,** inc.

DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN SPRINGFIELD (OHIO)




A. P. A. System operates barrels, racks, etc., through variety, full-cycle processes at same time, automatically.




***G-S Full-Cycle "Cogged-V-Belt" Drive Barrels***
***Original Equipment Choice of ABBEY-Matic***

**Standout performance wins for GS! Exclusive features: • GS "Cogged-V-Belt" Drive (U. S. Pat. 2,562,084) • Better, Faster Plating • Less Maintenance • Heavier Loads • Floating End Plates • Automatic Positioning • Inverted V-Contacts or 3-Point Suspension (Horn-Type) • Heavier Dangler Cables • Floating Hubs • Faster Dangler Cleaning • Danglers Won't "Ride-Up" • Adjustable Bearings • Most Rugged, All-Welded "H-T Sincolite" or Tempron Cylinders • Total Cylinder Immersion.**

**SEND FOR DETAILS AND BULLETIN GSB102.**

## *Produces Big-Plant Variety and Volume . . . . without Manhours and Hoists*

It's the *ABBEY-Matic!* (Abbey Process Automation System, patent-protected.) World's first and only completely flexible automation for multi-processing and job-type plating — *without limitations.* Out-dates every conception of automatic plating. Never before so many "firsts" in a single equipment development in the industry. ABBEY-Matic adapts to *your exact needs;* your *premises,* your *tank lines, barrels, racks, etc.,* your *processing* — regardless of *variety* and *volume.* Handles your complex schedules of multiple treatments simultaneously, without a single manual operation. Plating, anodizing, cleaning, pickling, etc. are individually processed (full cycle) with perfect precision, independent of each other, by remote central control. Vary cycles at will. Perfected, fail-proof, ABBEY-Matic does a heretofore "impossible" combination of operations automatically. Eliminates human element, eliminates chain hoists. Speeds production, boosts earnings; cuts cost. Installs in single-station sections on any floor, in any area. No anchoring. Extend or reduce easily. Nothing offers greater potential for your multi-processing today than a thorough understanding of ABBEY-Matic. See opp. page and write for details.

## *The G.S. EQUIPMENT Co.*

**15585 Brookpark Rd. • Cleveland 11, Ohio • CLearwater 2-4774**

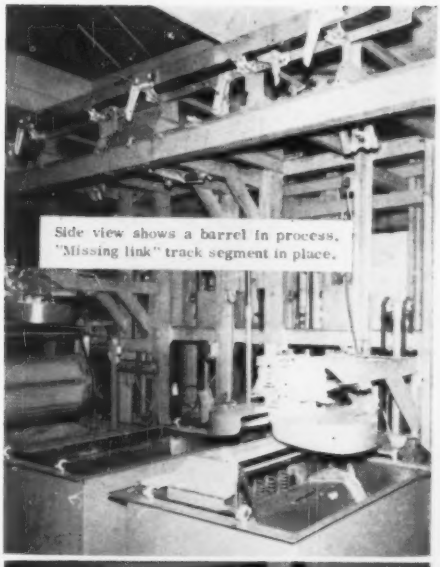


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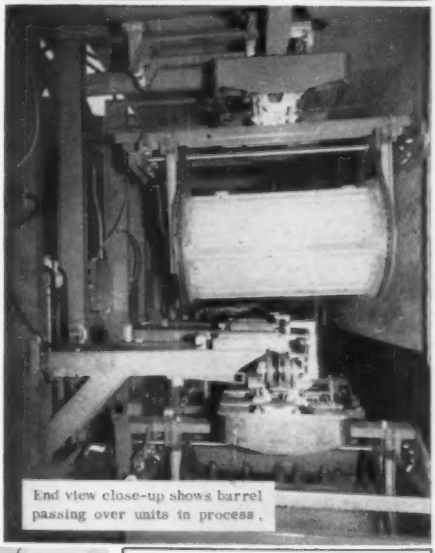


# ALL SET

## *to Launch a New Era of Multi-Process AUTOMATION . . .*



Side view shows a barrel in process. "Missing link" track segment in place.



End view close-up shows barrel passing over units in process.

### *ABBEY-Matic Goes All the Way! . . . . .*

First to break the fixed-sequence and synchronization "barriers" in process automation, ABBEY-Matic positions work carriers progressively over process stations and immerses the work in *predetermined* sequences or cycles. Multiple processing is completed in a single system without interference or confliction between carriers — without manual operations, without hoists. Each carrier functions as a robot, independently, by remote control, to the completion of its process cycles. Full flexibility permits unlimited variations in precision timing, sequence, selectivity, etc., of all treatments at any point during operations.

***ABBEY-Matic: New, Unique, Revolutionary.*** Incorporates new principles of automation, actuated and controlled by fail-proof electro-hydraulic devices. Only ABBEY-Matic can "leap-frog" work carriers out of sequence with each other, selecting their own treatment cycles. Only ABBEY-Matic allows for integrating processing cycles with any power and free conveying system. Provides for carrier accumulation, periodic feeding or loading. Then, after processing, conveys to any location for unloading, reloading, and return to processing.

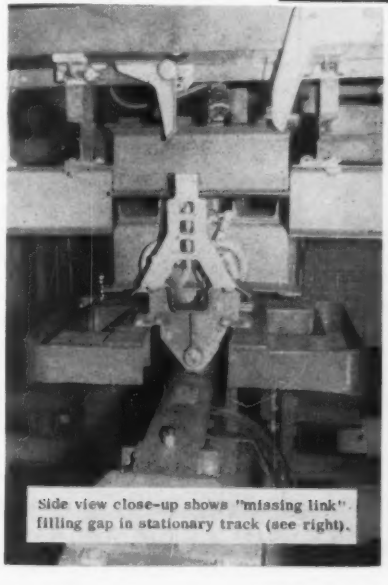
***ABBEY-Matic Supplies "Missing Link".*** Each work carrier is independent of all others and is suspended from a free-wheeled truck on overhead monorail. It is transferred or conveyed by any power means, and is circulated throughout the ABBEY-Matic by reciprocating latches or pusher dogs on a moving chain. Each carrier is lowered for immersion at proper station by an individually powered and controlled station-elevator. Elevator disengages track segment which lowers carrier for work immersion, and replaces it with a "missing link" segment (see diag.). With "missing link" segment in track, other carriers "leap-frog" those in process without complication. Only ABBEY-Matic provides self-sequencing by carrier selection. The carrier itself has its own signaling means for its processing and cycling.

***Watch this space for details on***

ABBEY-Matic Cycle Selection, Accumulation, Feed and Load, Rapid Transfer and many other Special Features. All patent-protected.

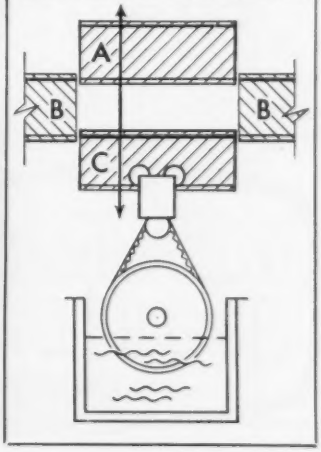
Write your nearest APA System distributor, or Abbey Process Automation, Inc. (below) for complete information.

**ABBEY PROCESS AUTOMATION INC.**
**37-01 48th Ave., Long Island City 1, N. Y.**
**RAvenswood 9-0592**



Side view close-up shows "missing link" filling gap in stationary track (see right).

As bottom track-segment "C" lowers carrier to tank, "missing link" track-segment "A" drops into place, closing gap in track "B". Other carriers travel over units in process, all-automatic.



# The *NEW* MITCHELL-BRADFORD Emulsion Cleaner #26

**A NEW organic emulsion cleaner designed for easy removal of heavy oils, greases and soils.**

**EMULSION CLEANER #26** is a general utility cleaner which cuts cleaning time when used prior to an alkali cleaner. Emulsion Cleaner #26 will even increase the life of the alkali cleaner.

**EMULSION CLEANER #26** softens grease and grime for easy removal with a cold water rinse.

**EMULSION CLEANER #26** will easily remove buffing compounds and is ideal for cleaning heavy machinery, airplane bodies, truck bodies, floors, etc.

## *Advantages*

1. High penetrating ability.
2. Softens grease and oil for easy water removal.
3. Ideal for cleaning all ferrous and non-ferrous metals.
4. Economical.
5. Long lasting.
6. Used at room temperature.

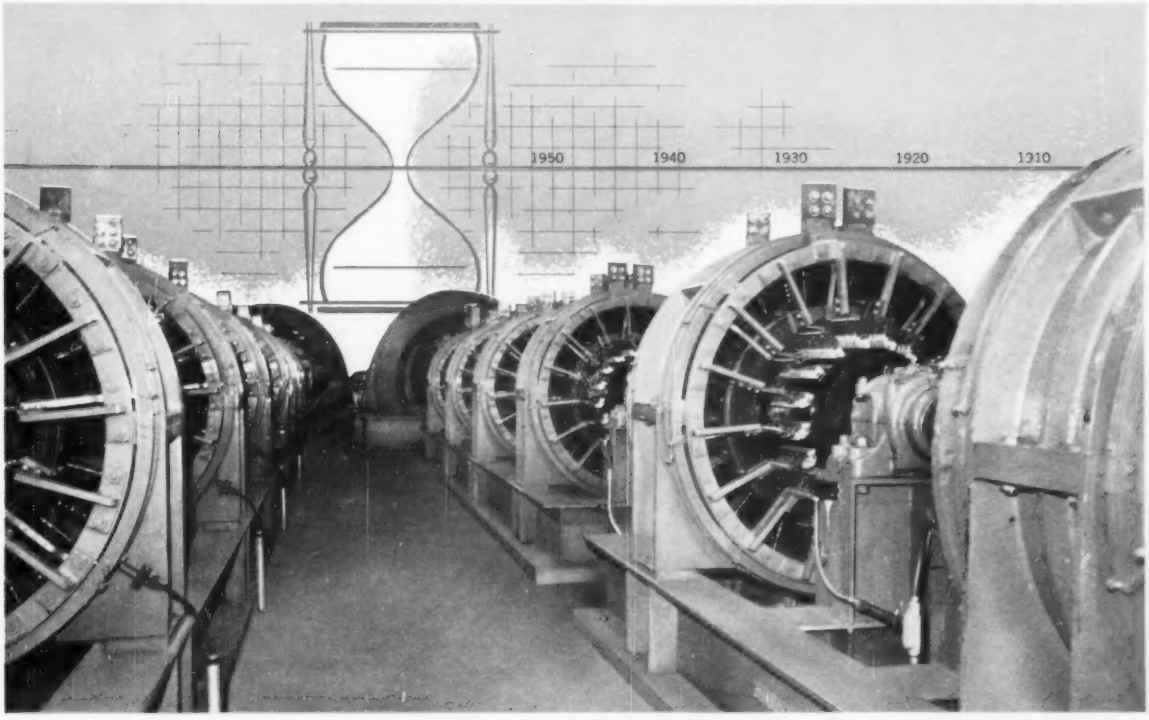
***For Paint Stripping requirements investigate our NEW non-inflammable QUICK-STRIP #8.***

**MITCHELL-BRADFORD CHEMICAL CO.**
**WAMPUS LANE MILFORD, CONNECTICUT**

Mitchell-Bradford

**QUALITY PRODUCTS OF CHEMICAL RESEARCH**

# LONGEST life... AT HIGHEST CONTINUOUS PERFORMANCE




## ...PROOF THAT MOTOR GENERATORS ARE YOUR BEST INVESTMENT IN POWER CONVERSION EQUIPMENT

*Chandeysson* **generators live 4 times longer—no efficiency drop due to age or overload**

When you buy a Chandeysson Motor Generator, you're investing in lifetime power conversion of highest quality performance, exceptionally low maintenance cost. Year in and year out, Chandeysson M. G. sets keep running steadily, *dependably*. Life expectancy is well over 40 years . . . compared to possibly 10 years for other forms of power conversion equipment. Also, Chandeysson sets give you sustained, lifetime overall efficiency . . . as high as 85% . . . that doesn't decrease with age or overload.

**Long life** is just one of many reasons why the plating industry *insists* on Chandeysson low-voltage generators for direct current power needs . . . for extra capacity to meet emergencies at the lowest possible cost.

*For full information, write now for new booklet D-103.*

**CHANDEYSSON ELECTRIC COMPANY**

4074 Bingham Avenue • St. Louis 16, Missouri

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# MIGHTY COOL WAY TO CUT OR COLOR METALS...

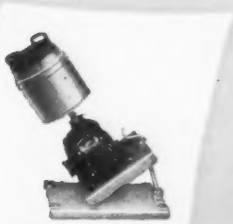
## WITH AHCO LIQUID BUFFING COMPOUNDS

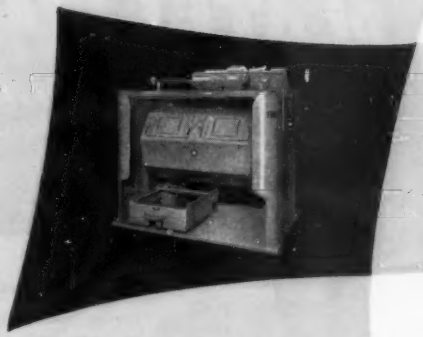
Ahco Liquid Buffing Compounds are made with the same high-grade abrasives as Ahco bar compounds, but with an emulsion-type liquid binder. These versatile compounds may be applied in several ways: the work or the buff may be sprayed, or the work may be dipped or brushed before buffing. The amount of compound applied to a wheel or buff can be more easily controlled; buffs run cooler — thus eliminating a fire hazard and lengthening buff life. Work surfaces clean more easily; there are no nubbins left over, so you save compound. AHCO Liquic Compounds are especially suitable for automatic buffing



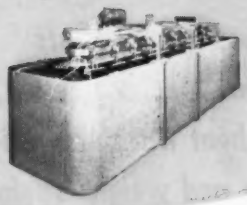

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APOTHECARIES HALL CO.
DIVISION
HUBBARD-HALL CHEMICAL CO.
WATERBURY · CONNECTICUT

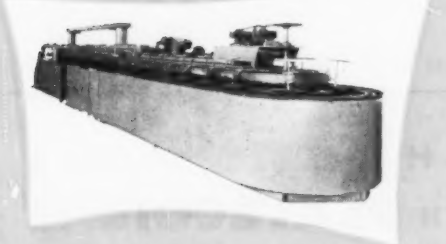








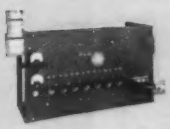
# CROWN equipment



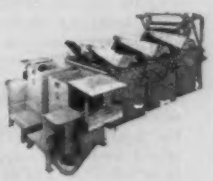
- Automatic Machines for Plating-Anodizing, etc.
- Dryers, Centrifugal
- Partially Automatic Plating Machines
- Plating Barrels
- Rectifiers
- Rheostats, Switches — Controls
- Tray — Transfer Type Cleaning — Rinsing — Dipping Units
- Tumbling Barrels — "Horizontal" — "Tilting"
- Special equipment designed and built











COMPLETE DETAILS SENT PROMPTLY ON REQUEST

**CROWN RHEOSTAT AND SUPPLY COMPANY**

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

pipe coils are old fashioned...

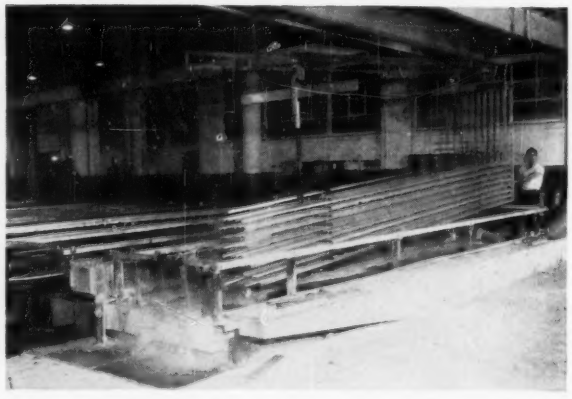


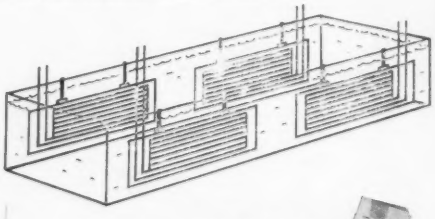
modern PLATECOIL® cuts heating and cooling costs

low installation costs
low maintenance costs
high heat transfer efficiency
space and weight savings

PITTSBURGH PLATE GLASS SAVES WITH PLATECOIL® IN ANODIZING PROCESS

PLATECOIL replaced pipe coils which were used to heat aluminum finishing solutions at PITTSBURGH PLATE GLASS WORKS NO. 19 at Kokomo, Indiana. This company reports reduction of installation and maintenance costs to half the cost of using pipe coils. The PLATECOIL units also require about half the space required by pipe coils in cleaning, etch, anodizing and sealing tanks. The higher efficiency of PLATECOIL resulted in the use of fewer units. The drawing shows the position of PLATECOIL units in the aluminum finishing tanks. Aluminum moldings are shown in tanks in which PLATECOIL units are used.





SEND FOR FREE BULLETIN P-52.



Tranter Manufacturing inc.

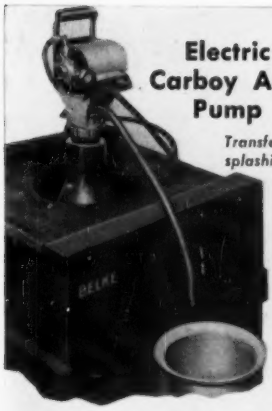
LANSING 9, MICHIGAN

PLATECOIL® DIVISION

# HARD TO FIND PLATING ROOM ACCESSORIES

*If you don't find it here — write.*

## Electric Carboy Acid Pump

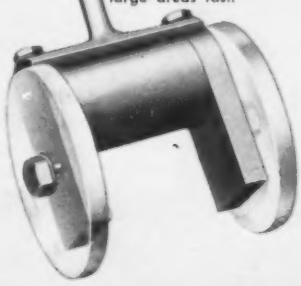


*Transfers quickly, — safely — no splashing or blurping.*

Self sealing rubber connector fits into carboy like a cork. Forces acid out in even flow. Air Safety Valve Lever stops flow instantly. Fits all standard 13 gal. carboys. Easily adapted to 6½ and 5 gal.

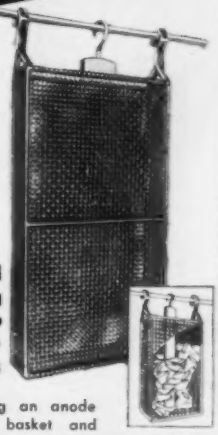
With lead tubing $81.40
With plastic tubing 86.90

## Permanent Tank Magnets



Pick up work from bottom of tank—also work clinging to plating barrels. Picks iron and steel chips from brass, copper, zinc, sawdust, etc. Available with or without wheels. Also assembled in "gangs" to cover large areas fast.

## Nickel Saving Scrap Anode Baskets

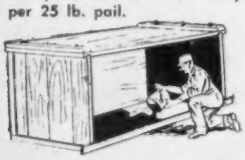


Merely hang an anode inside the basket and pour the scrap anodes around it. Ruggedly made—insulated. Specify length, width and depth when ordering.

## Easy to apply Rubberite Tank Lining

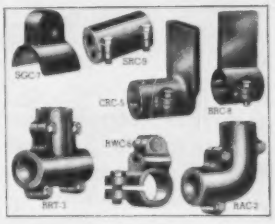
Make a lasting lining that protects wood or metal tanks from acids and alkalies at room temperatures. Easily applied right in your plant. Just heat and pour on to thickness desired. Will not crack, scale or peel in hottest weather. Very economical. 2 pounds lines one square foot ¼" thick. Only $4.75 per 25 lb. pail.



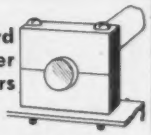



## Cast Copper Bus Bar Connectors

All shapes and sizes
Order by number and specify diameter of openings

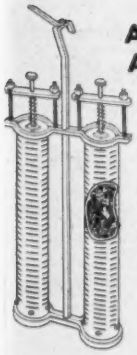


## Hard Rubber Insulators



For 1" or 1¼" rods $1.95
For 1½" rods,..... 2.20
For 2" rods,..... 5.50

## Aluminum Parts Anodizing Rack



Fast loading — time saving. For rivets, bolts, washers and other small aluminum parts. Just pour parts into the tubes and insert plunger. Spring tension makes positive contact between parts. Standard tubes are 22½" long, 2½" O.D.

## Newest Style Ball Anode Baskets




For round or flat top anodes. No lodging. Heavy gauge steel, welded.

| Dim. A | Dim. B | Price each |
|---|---|---|
| 16" | 4" | $1.15 |
| 20" | 4" | 1.20 |
| 25" | 5" | 1.40 |
| 31" | 5" | 1.55 |

Other dimensions to order.

## Fast Loading and Unloading Racks for Chrome Plating Screws, bolts, rivets, etc.

To load—stretch rack on racking board. Insert pieces. Release rack to lock pieces under tension.

To unload—Hold rack over container and stretch. Made of ⅛" phosphor bronze. Holds parts to ¼" diameter.

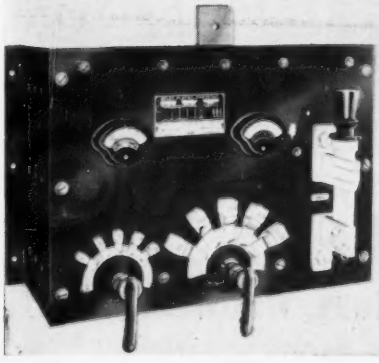


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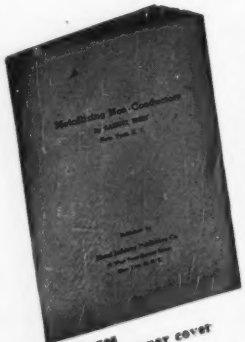
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The text is prepared in a practical fashion so that the formulas given will be of material use and is the result of literature collected by the author for more than 25 years and which has been in use by a number of industrial concerns here in the United States and abroad.

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## by Ben P. Sax

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Sincerely,

Ben P. Sax

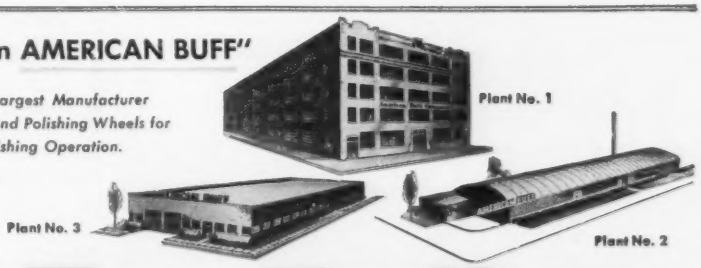

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*Are you interested in plating specialties?* *See the other side of this insert*

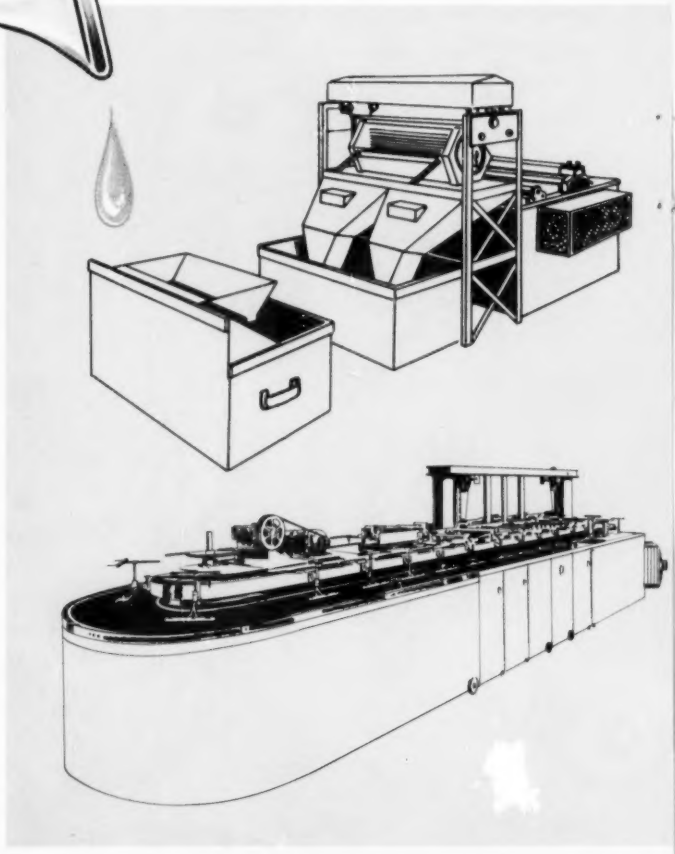
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## Tolerant to Contaminants

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**Formulations available that do not require tartrates or tartrate substitutes**

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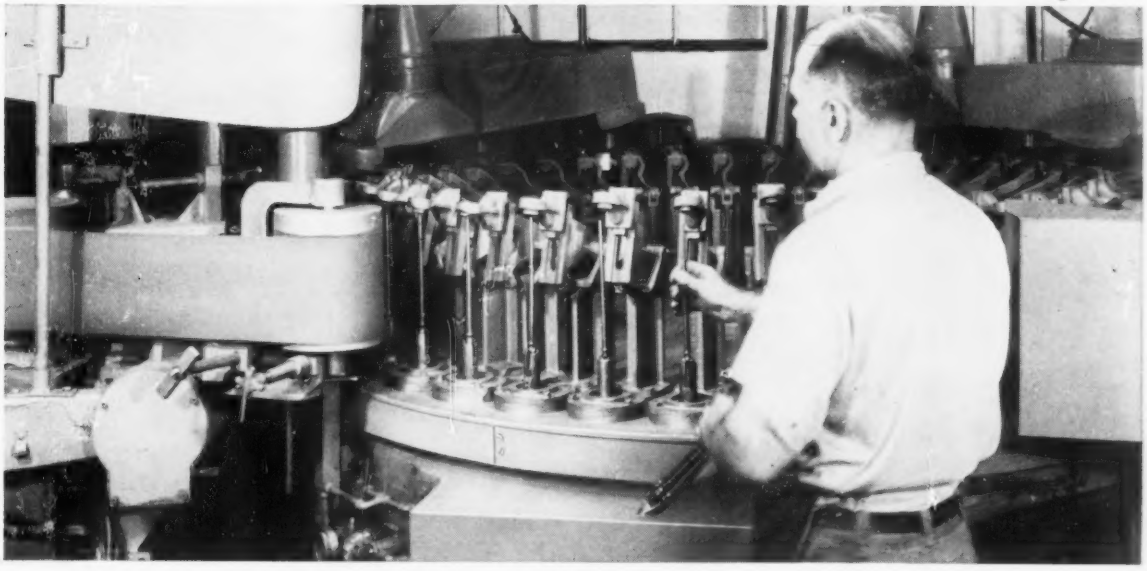
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**MATERIAL:** 10-38 steel forgings.

**ABRASIVE BELT:** Four MICHIGAN RED COAT A/O metal-working cloth belts.

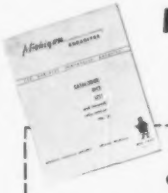
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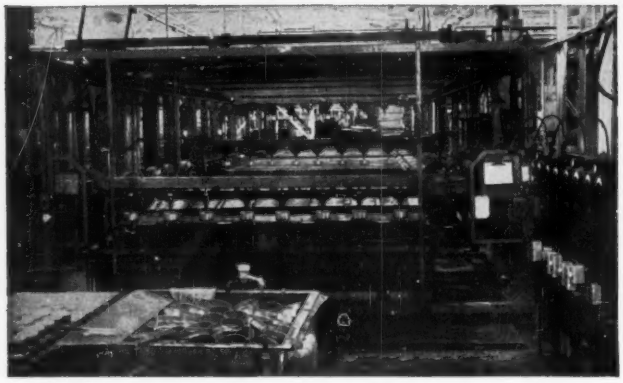


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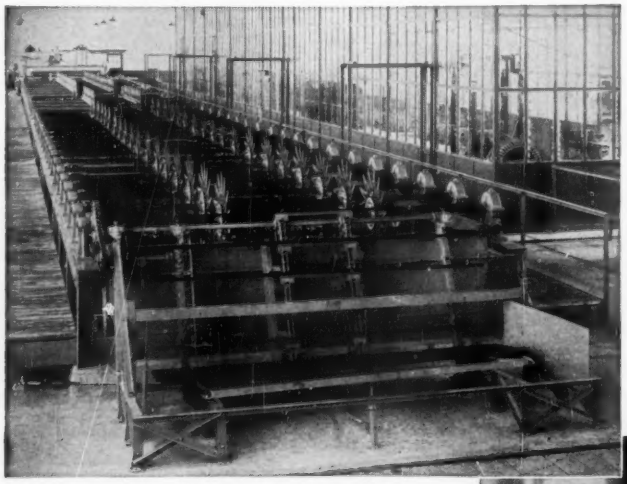
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U.S. Equipment leads where production problems call for ingenious engineering and design for improving quality and lowering costs. Whether your job calls for Electroplating, Electrochemical Treatment, Metal Cleaning, Pickling, Acid Dipping, Drying or other related operations in any required series or combination —intermittent or continuous—it will pay to get U.S. recommendations. Our Service Department is at your disposal, without obligation.



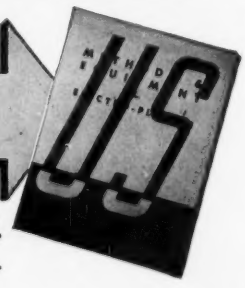
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JANUARY, 1958 Volume 56 Number 1

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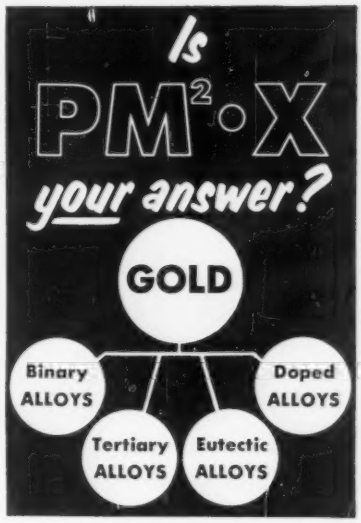
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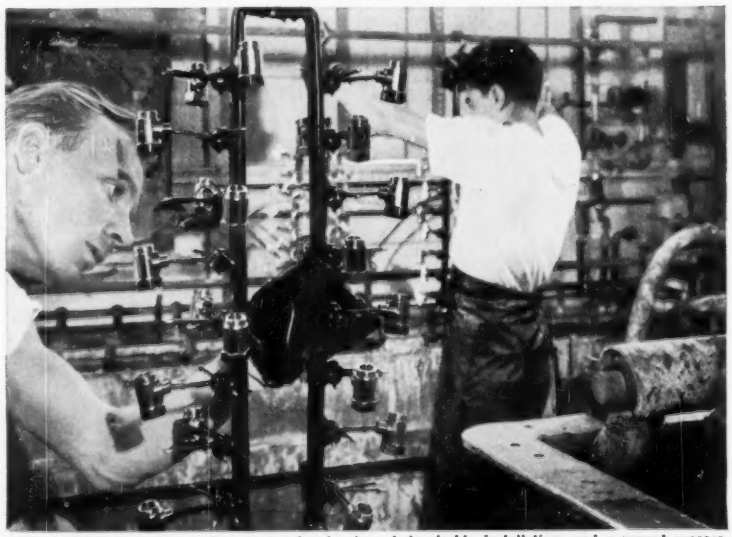
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*Photo courtesy Pottstown Plating Works, Inc.*

Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
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ESTABLISHED 1903 VOLUME 56 • NUMBER 1 • JANUARY, 1958

# The Outlook for 1958

This is the month when editors are expected to look into their crystal balls and forecast what is in store for the world of industry in general, and for their own readers in particular.

When the Director of Defense Mobilization, on October 3rd, authorized the diversion to industry of all nickel scheduled for shipment to the government in 1958, anodes in quantity immediately appeared on the market, seemingly from nowhere, and the sun began to shine again for platers. According to estimates of the Department of Commerce, this diversion will increase to 245 million pounds the amount of nickel expected to be available for non-defense uses in 1958.

In the face of indicated cutbacks in the aircraft industry and increasing production resulting from the expansion program encouraged by our government eight years ago, more nickel will be available each year until 1960, when annual output is expected to reach between 650 and 675 million pounds. This is about seventy-five percent more than total annual consumption today and means that a buyers' market is in prospect. Canadian nickel still dominates the industry but Cuba is knocking at the door and it looks like the plater can look forward to the day, in the not-too-distant future, when salesmen will be pressing him to buy their anodes.

Whether nickel consumption for plating will increase in proportion to our industry's growth is still to be seen. Anodized aluminum has been encroaching on the market formerly served by nickel plating. The extent to which this year's car models are sporting anodized aluminum grilles and trim may be a portent since, obviously, nickel shortages can no longer account for the switch. Aluminum is in plentiful supply; in fact, a surplus is expected throughout the free world.

The temporary oversupply of copper recently should not lull users into maintenance of marginal inventories. We have warned our readers time and time again over the years that it doesn't pay to gamble on being able to obtain material on short notice. A lot of output can be lost because of lack of a few hundred pounds of anodes should conditions change overnight, as they have before, and may again!

Other metals and finishing materials are in good supply and no drastic changes in the situation are anticipated. We can safely predict a normal supply year. Whether there will be enough profitable business around to make use of these supplies, however, is another matter. Authorities differ widely on business prospects during the coming year and, since this particular editor is a confirmed pessimist, his prognostication might be colored accordingly. Therefore, we'll avoid any comment on the subject.

Nathaniel Hall

# Technical Developments of 1957

By Nathaniel Hall, *Technical Editor*

### *Cleaning*

ALTHOUGH the technical and patent literature produced the expected volume of developments, during 1957, in the field of metal finishing, cleaning appeared to be one subject which did not receive the attention warranted by its importance. As a matter of fact, all four of the articles worthy of note happened to make their appearance in this magazine, which is flattering even if coincidental. In an article on the *selection of materials and methods*, Spencer[1] showed how proper cleaning methods pay dividends. Mohler[2] discussed the *life of alkaline cleaning baths*, and Serota surveyed the subject in one article[3] and evaluated cleaners in another.[4]

Of the ten patents in this phase of metal finishing, five disclosed innovations in *fused bath treatment*. Webster patented a process for electro cleaning in a *melt of caustic and fluosilicate*,[5] Carter[5A] claimed a fused caustic bath containing a hydride and an iron compound, and equipment inventions were claimed by Faler[6,7] and by Dunlevy & Shoemaker.[8] In addition, Brown divulged a method for anodically *cleaning* vanadium using carbonate and bicarbonate,[9] while patents were issued to Phillips & Lawrence for a *sheet cleaning machine*,[10] to Zademach for a *rotary table machine*,[11] and to Faler, Allen & Stanton[12] for a *drum type* perforated unit.

*Ultrasonics* in cleaning and degreasing was treated in an article by Bulat[13] and in patents granted to Brown,[14] and to Kearney.[15]

Three articles appeared on *solvent vapor degreasing*. Kircher reviewed *trichlorethylene solvents*, their stabilization and evaluation[16] in one paper, and pointed out when to use solvent vapor degreasing in another.[17] The function and effective use of the *water separator* was detailed by Randall in the third article.[18] Among the patents, a *solvent emulsion* containing an alkali metal alkyl sulfate derived from shale oil was claimed by Stewart.[19] All other patents concerned equipment and were granted to Jones & White[20] for one with an oscillating *helical conveyor*, to Lans for a *cooling water arrangement*,[21] to Legler[22] for an improved machine, and to Kearney[23] for an *automatic solvent degreaser*. The use of *high velocity steam blast* rather than solvent was covered by Snape in a machine for degreasing ribbon steel.[24]

The field of *abrasive blasting* was less active in the literature than in previous years, consisting of one article in which Occhsle & LeFevre discussed *proper methods* of blasting prior to coating in order to obtain suitable adhesion,[25] and four patents, one to Haberl for a *grit of iron alloy* of specified composition,[26] and another to Sprigg & Venner[27] for a *nozzle assembly*. The other two, on equipment, were granted to Mead & Zambruno[28] and to Liebman,[29] the latter for a centrifugal unit.

### *Pickling*

Developments in this phase of the art were highlighted by *treatments for titanium*, one of the newest of the wonder metals, aside from which very little came to light of major importance. McKinsey, Stern & Perkins investigated the *absorption of hydrogen* during pickling of titanium,[30] while Alexander & Farrel[31] employed a *fused bath* of alkali metal hydroxide containing dissolved titanium to repress this absorption in the course of scale removal. A patent was granted to Dailey[32] on a *cathodic descaling process* using a solution of hydrofluoric, tungstic and sulfuric acid plus ferrous or aluminum sulfate and, in an article which would be of most interest to platers, Missel described the results of his study of the production of *adherent chromium deposits* on this metal, using acid-dichromate pickling pretreatments.[33] Pickling for *adhesion of subsequent deposits* was also the subject of a report by Sellers & Sanborn,[34] who detailed activating treatments for *plating on nickel* and its alloys.

Only one other article was considered of interest, on *acid control of pickling* prior to galvanizing, in order to reduce waste, published by Collins.[35] All other developments were disclosed in the patent literature, Streicher[36] claiming a solution of phosphoric acid containing ferric ions for *stainless steel*, Treece[37] suggesting an acid solution of thiourea and thiosemicarbazide for *tarnish removal from silver* articles where another metal is exposed and in contact with

the silver, and *pickling inhibitors* developed by Rohrback,[38] by Gardner & Saukaitis,[39] and by Hager, Michel & Rosenthal.[40]

### *Polishing*

MECHANICAL:

A year ago, we remarked about the regular yearly increase in the amount of information published concerning mechanical polishing and buffing. The unusual jump in the rate of increase during 1957, mainly in the patent literature, might cause one to speculate on a possible relationship between rise in labor cost and interest in more efficient methods, especially since polishing and buffing are usually the most expensive operations in the finishing cycle.

Two valuable investigations were reported during the year. Samuels studied the *deformed layer produced by polishing*[41,42] to determine the possibility of developing strain-free surfaces. His evidence indicated that the existence of the well-known Beilby layer is unlikely. Also, Candee & Henn[43] determined the optimum spray application conditions for *liquid buffing compositions*, using a ventilated cloth buffing wheel, to obtain maximum metal removal. A survey of *polishing nickel* and high nickel alloys was presented by Spencer from a practical standpoint,[44] while Paret[45] covered methods for *stainless steel*.

*Set-up wheels* and *belt polishing* were treated in five articles but were also the subject of an exceptionally large number of patent claims. Burt described the preparation of set-up wheels[46] and their use, *cost-cutting* with belts and belt machines was demonstrated by Reid,[47] the selection of suitable *contact wheels* and the determination of *optimum operating conditions* were covered by Seward,[48] also the preparation of surfaces for plating, employing *coated abrasives*.[49] The same author listed the points to remember in the use of *abrasive wheels*.[50]

*Belt polishing machines* were described in patents granted to Lewis,[51,52] Jones,[53] Schaller,[54] and to Linden & Lennon.[55] A *contact wheel* was claimed by Cosmos,[56] and a *backstand idler* by Johnson.[57] *Coated abrasive wheels* were patented by Block,[58] Bernstein & Block,[59] Thomson & Latessa,[60] and Ballato.[61]

Improvements in *buffs and buff making* were detailed in a large number of patents, which will not be discussed here because of limited space, but which are listed in the references.[62-9] In addition, one patent was granted to Housdorfer,[70] on a *buffing compound applicator*. *Rotary brushes* were claimed by Schofield[71] and by Nielson,[72] and a *cup brush* of novel construction was disclosed by Nelson.[73] Other mechanical innovations included a machine using a *rotary burnishing element*, invented by Kinker,[74] a *deburring and polishing* machine, claimed by von der Linden & Yacus,[75] and a *gyrofinishing* unit, disclosed by Diehl & Purcell.[76]

CHEMICAL AND ELECTROLYTIC:

Although interest in chemical and electrolytic polishing has been increasing rather than declining, gleanings from the literature on these subjects were most meager, comprising only three articles and three patents. Brace[77] surveyed the fundamentals and operation of the various *bright dipping processes* in use and described the influence of composition and structure of the alloy on the brightness obtained,[78] while Ledford & Jumer[79] detailed the *effect of contaminants* in phosphoric acid-base brightening baths, suggesting methods for their removal, which included activated carbon for organics and ion exchange for aluminum.

The field of *electropolishing* was covered by three items, all in patent disclosures. Heinrich claimed the use of saturated sodium chloride containing a small amount of methyl cellulose for *deburring non-ferrous metals*,[80] Anzaldi divulged a *magnetic racking* method,[81] and Treuhaft & Swanson were responsible for a semi-automatic *electropolishing machine*.[82]

BARREL FINISHING:

Although, as is to be expected in a field where very few established principles can be employed and trial and error are the accepted procedures, most articles might be considered quite repetitive by the practitioner, they are a necessary part of the trade literature because newcomers require basic information. Along these lines, Kohler compiled an extended practical review[83] covering the *elements of barrel operation*, types of barrels, linings, media and compounds, and production details. Spencer also discussed the *variables* to be considered and the *equipment* employed,[84] as did Glasrud,[85] while Fitch[86] presented a list of "do's and don'ts."

In other articles of interest, Schaefer & Messenger[87] described the use of *steel balls and shapes*, and Glasrud & Smith detailed the effect of *media size* and *time cycle* on barrel finishing results.[88] Processing of *large parts on fixtures* was the subject of articles by Gurnham[89] and by Brandt.[90] A very ingenious set-up employing *oscillating equipment* and a converted paint mixer for *finishing precision parts* was described by Hopewell.[91] Only one patent was granted, to Heaphy for a *tumbling barrel* with a vibrator unit.[92]

### *Aluminum — Anodizing and Plating*

The emphasis on practical aspects of anodizing and plating on aluminum, which was quite evident during the previous year, continued in 1957 with very few developments arriving, especially in the patent department, and only one investigation worthy of note, by Andrus[93] on special *electrolytes for anodizing*, none of which were found better than the presently employed baths. Vanden Berg[94] presented a general treatment of the *characteristics* of anodized aluminum and Nixon & Kahler[95] listed the requirements and procedure for *anodizing and dyeing auto trim parts*. Spooner studied methods for *sealing sulfuric acid anodized aluminum* to determine the effects of various conditions on the degree of sealing.[96] He confirmed the value of water sealing but found that prolonged treatment was of no advantage. Other articles included one by Bunch on *anodizing racks*,[97] and details on various methods of producing *thick films*, sometimes called "hard coating," presented by Sweet[98] and by Kape,[99] the latter a very complete survey of the subject.

In the patent disclosures, Sonnino[100] produced *flexible films* in chromic acid baths containing triva-

lent chromium and metal dichromates, and Robinson produced the oxide film by first *anodizing to form a porous oxide*, then depositing a film of aluminum in the pores, which was finally converted to the oxide.[101] *Multicolor decoration* was the subject of two patents, granted to Sobol[102] and to Patrick,[103] while a *fast dye* of the monoazo type was claimed by Zickendraht & Wittwer,[104] and a *metal-organic compound* which is easily hydrolyzed was disclosed by Cunningham & Levitin.[105]

*Plating on aluminum* received practically no attention in the literature, only one invention coming to light, a method involving *anodizing* in a zinc cyanide plating solution, followed by plating in the same bath, to obtain adhesion, disclosed by Connor & Blumberg.[106] Wernick & Pinner surveyed the subject in detail[107] and described the *variations in pretreatment*, while Aves[108] presented a method of applying zinc, copper, nickel and chromium to *aluminum landing gear components*, along with test results on plated corrosion panels.

### *Metallic Coatings*

NICKEL:

The most evident feature of the year was the relatively small number of bright nickel patentees. Possibly, the researchers have run out of organic chemicals to try but, in any case, Brown received six on various *brightening compounds*,[109] DuRose & Little were granted five,[110] and one was received by Ellis.[111] Abstracts of these patents have appeared in recent issues of METAL FINISHING and will not be described here. In the course of a study of *fuchsin brightener*, Dye & Klingenmaier[112] recovered the material from the nickel deposits by solution of the latter in HCl and found the amount obtained was roughly linear with concentration in the plating bath, also decreasing with increasing current density. The *reaction mechanism* of nickel brighteners was considered by Bellobono,[113] who discussed coordination compounds and the plating potentials of metals in relation to theories propounded to account for bright deposits.

Edwards tested rubber accelerators and anti-oxidants in *tank linings*[114] and determined that only two materials were completely without deleterious effects, while Smith & Bacon[115] found that *calcium* has no effect on the nickel deposit, which is fortunate in view of the absence of effective removal methods. There were three other studies worthy of note. Jones, Lu & Zajdowski[116] described the effect of different ferrous metals on the *performance of a Watts nickel deposit*, While Dale & Lutwak[117] suggested that the effect of *silicon in low-alloy steel* on adhesion of heavy nickel deposits was due to formation of a film during the customary anodic sulfuric acid pretreatment. These investigators found that improved adhesion resulted if the anodic treatment was followed by a *caustic soda dip* to dissolve the silicic acid formed. The third paper was a metallographic study which showed, according to Runck,[118] that either nickel or cobalt afforded considerable *protection to molybdenum* at high temperature, and that chromium followed by nickel was better than either alone.

One patent was granted to Cowle, et. al.,[119] on a *sulfate or sulfamate bath* containing sodium or potassium chloride with a nickel to chloride ratio of 1:8, and two application patents were obtained, one by Frey on a *patterned deposit* produced by first anodizing the basis metal in alkaline silicate to produce an invisible film.[120] Also, Hammond & Bowman claimed the *application of nickel, followed by zinc and phosphate* to polished flat steel strip; the article is then formed, the phosphate and zinc stripped, the nickel electropolished and activated, and a final nickel then applied,[121] all of which appears quite complicated but probably has worthwhile advantages.

"Electroless" or *catalytic* nickel plating was treated in only two patents, one to Talmey on a process for coating interior surfaces of *hollow articles*,[122] and the other to Chambers & Spaulding,[123] who circulated the solution through a *filter packed with nickel salt* to replenish the metal content and filter out solids, the bath being cooled just before filtering. In the technical literature, Minjer & Brenner, in research on the *rate of deposition and corrosion resistance*,[124] found the method to produce better deposits than electrodeposition. They tried a number of *organic acids* in the bath, none of which appeared to offer any improvement over the original glycolic acid, and also determined *optimum conditions of operation*. According to Goldenstein, Rostoker & Schossberger,[125] x-ray and electron diffraction studies of the *structure of the deposit* shows it to be an amorphous solid, and unrelated to the nature of the base. In other papers, Royen described the *influence of heat treatment* on the properties of electroless nickel,[126] and Sullivan & Eigler[127] suggested its *application to silicon* for use as an electrical contact.

CHROMIUM:

Activity in this phase of the industry did not extend to the literature during 1957. Two investigations came to light, in one of which Powell[128] studied the *influence of heat treatment* on electrical resistivity and thermal conductivity of electro-deposited chromium, and the other consisting of a preliminary study by Hoover[129] of the *direct deposition over chromated zinc*, an interesting study in which many details were reported but, so far as we could see, not a single mention of the temperature at which the chromium plating solution was operated.

Other developments in chromium plating consisted of a new method of *cleaning anodes* by soaking in a mixture of caustic soda and rochelle salt, suggested by Missel,[130] and a discussion of *unconventional plating methods* by Mohler.[131] British practice *in plating gun barrels* was described in complete detail by Hammond,[132] and a *nitrided gun barrel* with a chromium deposit was patented by Osborn.[133] Among the inventions were also an *anode for plating crank pins*, issued to Berry,[134] and a method of *preventing etching* of non-plated parts in the chromium solution by first cathodically treating in a chromic acid solution to form a protective film, claimed by Stareck & Dow.[135]

In connection with solutions, Zell patented a *trivalent bath* consisting of chromic sulfate, urea, a sulfate, and formamide,[136] this bath also having been detailed in the literature.[137] A *crack-free bath* contain-

ing sulfate and fluosilicate was disclosed by Stareck & Dow[138] and a number of patents were granted to Stareck, Seyb & Passal for baths and methods of reducing the *fatigue strength* of chromium plated high strength and hard steels, employing both sulfate and fluosilicate catalysts[139-41] Finally, DuRose claimed the *reduction of sludge* by adding cobaltous ion to a sulfate bath which contained acetate, fluoborate and fluosilicate.[142]

COPPER:

A normal amount of work was indicated in this field, as disclosed in the press. Two research papers appeared, on the deposit. In one, Overston, Parker & Robinson studied *filamentary growths*, defining the conditions of growth and discussing the possible mechanisms to explain them.[143] In the other, Suzuki determined the effects of *microstructure of the basis metal* on strain figures which appear on the surface of copper deposits subjected to fatigue.[144] In an investigation of *copper complexes* in cyanide solutions, Rothbaum[145] confirmed the presence of $Cu(CN)_4^{---}$ ions.

Other articles consisted of a discussion of cyanide and *pyrophosphate copper plating baths*, brightening and leveling action, and applications, by Weimer,[146] and suggestions for making the best use of the *rochelle salt-cyanide* copper bath, by Mercadov.[147] New *addition agents* claimed by the inventors, consisted of dextrose and 1-acetyl-2-thiohydantoin, patented by Woehrle & Condon for acid copper baths,[148] lithium cyanide and hydroxide, claimed by Ceresa & Woehrle,[149] a *brightener* containing molybdenum, lead, cadmium and tin, granted to France,[150] and a *selenium chelate*, disclosed by Portzer & Leitenberger,[151] the last three patents being for cyanide baths. An *anode* for cyanide solutions, containing a small amount of nickel, cobalt, and iron, was the subject of a patent issued to Ostrow & Nobel.[152]

An interesting disclosure of an *electroless copper* formula was made by Cahill,[153] who was able to obtain catalytic deposits up to 0.001" thick by *reduction with formaldehyde* from an alkaline tartrate copper complex, and a patent was granted to Owen on a similar process,[154] employing a *tartaric salt of hydrazine* as the reducer, to produce a *copper backing* on silver mirrors.

PRECIOUS METALS:

Although very little was published on this subject in the previous year, there were sufficient developments during 1957 to warrant a separate section in this review. In the single article on *gold plating*, Grupp[155] described the production of the gold coating on the *earth-satellite*. A new method of insuring *adhesion of gold* to molybdenum, tungsten, and cobalt was patented by Russell,[156] who gold struck articles made of these metals, then heat treated at 2,000-2,500°F. prior to applying the subsequent gold deposit. Addition agents and *brighteners* for gold baths were treated in patents granted to Seegmiller[157] for *sulfonated castor oil*, to Rinker[158] for small amounts of *silver cyanide*, and to Volk[159] for the addition of a *buffer* to maintain the pH at 6.5-7.5. A condensation product of an aldehyde and carbon disulfide or xanthate was claimed by Fischer & Schwarze to be suitable for both silver and gold baths.[160]

There were two articles on *silver plating*, in one of which Warwick gave process details and *types of barrels*[161] and, in the other, Jorczyk described a *concentration cell* used to replenish the metal content when plating with *insoluble anodes*, the method having the advantage of avoiding decomposition of the solution.[162] The patent literature brought to light a method of *plating on titanium*, claimed by Slomin & Christensen,[163] which involved deoxidizing in a fluoborate-hydrofluoric acid bath, then transferring to a fluoborate silver bath for plating, without any intermediate rinse. Also, a dogbone shaped *extruded silver anode* was patented by Bayes, Langhans & Greenspan.[164]. Two new *brighteners* were disclosed, a *selenium compound* claimed by Ostrow,[165] and a *ketone-carbon disulfide* reaction product, by Kardos.[166]

Other cullings from the literature comprised a list of suggestions by Walter[167] for *rhodium plating* current-carrying parts such as contacts, and the production of thick, smooth, crack-free deposits of *platinum* from an acid chloride-chloroplatinate bath, patented by Atkinson.[168]

ALLOYS:

Surprisingly, only one article appeared on the subject of *brass plating*, by Strow[169] on the formulation and operation of these solutions. Other alloys, however, received more attention, especially those containing tin. Lowenheim reveiwed the literature and presented new data[170] concerning the corrosion resistance of *tin alloy deposits*, and Cohen found that the *cadmium-tin* alloy deposit was much better than cadmium alone.[171] *Tin-zinc* deposits, however, were inferior to either cadmium-tin or cadmium. Azzolino[172] described the production of *lead-tin* coatings on aircraft engine components from a fluoborate bath, and patents were granted to Heymann & Schmerling[173] for the use of lead as a brightener for *copper-tin baths*, and to Shockley[174] for a bright *tin-copper-cadmium* alloy deposit, using a cyanide-stannate-borate bath.

West described suitable production methods for *diffused nickel-cadmium* deposits,[175] and an *electroless* process for depositing *arsenic-zinc* alloys.[176] The results of further studies of the operating conditions and properties of alloys consisting of *79% nickel and 21% iron* were presented by Wolf,[177] and a chelate bath for *iron-zinc* alloys was patented by Salt.[178] The literature also disclosed a method, suggested by Shome,[179] for depositing *chromium-molybdenum* alloys with up to 1.7% of the latter metal, by adding molybdic acid to a standard chromium plating solution. Finally, a patent granted to Hardoen on a *protective coating for iron*,[180] involved deposition of zinc, followed by a deposit from a bath of manganese and ammonium sulfates, ammonium thiocyanate, and sodium molybdate.

OTHER METALS:

Preoccupation with advances in *zinc and cadmium* plating has dropped to almost negligible proportions in recent years. All the literature could produce were

a few patents and one article; the latter, presented by Dress,[181] described how *vacuum deposition of cadmium* on steel eliminated hydrogen embrittlement, which is indeed a valuable, if expected development. However, one might question the value of a salt spray comparison between a 0.0002-0.00025″ deposit of electrodeposited cadmium and a 0.0004″ vacuum coating and wonder why deposits of equal thickness were not compared. *Brightener* patents consisted of *sulfated oleic acid* and oleate esters, claimed by High & Hague for cadmium,[182] *polyepoxyamine* for cyanide zinc baths, disclosed by Winters,[183] and *peptone* for acid zinc sulfate solutions, granted to Chester & Main.[184] A zinc *fluoride-pyrophosphate-sulfate* bath, operating at pH of 10.2 to 10.8 was patented by DeLong[185] for *plating on magnesium.*

Other metals treated in the literature received only a minimum of attention. Tin was covered by an article in which Vaid & Rama Char showed that *pyrophosphate baths* gave good deposits over a wide range, using dextrin-gelatine as addition agents.[186] Rama Char also detailed pyrophosphate baths for *tin, copper, zinc, nickel and lead,* including formulas and operating conditions.[187] *Antimony baths* were disclosed in two patents, one to Smart[188] on an antimony-potassium tartrate bath containing ammonium citrate and a borate or fluoborate, and the other to DuRose on an alkaline solution of *tartrate or gluconate.*[189] An *iron sulfate* bath could produce *level and ductile deposits,* according to Safranek,[190] with the addition of a wetting agent and saccharin or phthalimide. An *immersion lead bath* for iron, consisting of a lead salt of monobasic hydroxy acids, was claimed by Kendall & Polar,[191] and another consisting of lead salt of polybasic acids, by Kendall and Wagner.[192] Buckingham claimed the production of *tungsten* deposits of any desired thickness[193] by depositing tungsten oxide coattings from a phosphotungstic acid bath, then reducing the oxide to metal at elevated temperatures, and repeating as often as necessary.

### *Electroforming — Metalizing — Vapor Coating*

Very little of importance developed in any of these fields during 1957. Electroforming presentations consisted of an article by Pope[194] describing the production of *linear accelerator structures* with 3/8″ thick copper deposits, and another by Bachman,[195] who detailed *copper-lead-brass* coating of iron drop wire on a continuous basis. Patents included *electroforming of wave guides,* granted to Goodman, Baptist & Rice,[196] *hollow articles,* disclosed by Rosenqvist,[197] and the production of *printing cylinders* ready for etching, which Eulner & Mueller[198] obtained by polish-brushing the copper coating with a brass wire brush during plating.

*Metalizing non-conductors* showed up in only one article, by Steffey,[199] who described the procedure for *silver paint* application to *ceramics,* firing and subsequent plating. Patent claims, however, were much more revealing. Oosterhout & Bol[200] applied a *conductive silver film* by heating the surface to 150-300°C., then applying a silver salt of a fatty acid, while Nieter claimed a method of *plating on perforated strip material.*[201] Other patents were granted on production of metallic films on non-conductors from the *vapor state,* a process more familiarly known as "gas plating." Recipients were Nack,[202] Nack, Homer & Whitacre,[203] Pawlyk for continuous lengths of non-conductor material,[204] and Ostrofsky & Ballard[205] for the use of a *chromium hexacarbonyl* process to coat a ceramic base.

Other patents were granted on processes of coating by *gas plating,* Alexander receiving one,[206] as did Goodman[207] for *aluminum coatings* using the hydride. *Chromium deposits* were claimed by Samuel,[208] employing ferrochromium and ammonium bifluoride, also by Becker & Steinberg,[209] and by Ostrofsky & Ballard.[210] *Molybdenum deposition* by hydrogen reduction of chloride vapors was the subject of a patent issued to Hill,[211] and deposition of this same metal inside large bore tubing, using *pentachloride vapor,* was claimed by Hegarty.[212] The use of a solid carbonyl to deposit *Group VI-a metals* was disclosed by Clough & Godley.[213]

*Vacuum deposition* appears to be established in a very efficient manner and the only developments were a patent on an improved apparatus, received by Moles,[214] and the use of the process to apply *cadmium coatings* on steel for protection, avoiding *hydrogen embrittlement,* which was discussed in the previous section of this review.[181]

### *Conversion Films — Corrosion Preventives*

In the broad area of *conversion coatings,* phosphates and chromates predominated, as usual, with a scattering of other processes. However, phosphates were the subject of a significant number of articles, while chromates were mainly evident in the patent pages. Along general lines, these coatings and their uses were surveyed by Fabian,[215] and a review of some proprietary process was offered by Lewis.[216]

Of the two articles noted on *chromates,* Ostrander discussed their use on *hot galvanized surfaces,*[217] and Pocock[218] described their role in *finishing aluminum* emphasizing the lack of any realistic performance standards. Solutions for various purposes were the subject of patents. Schuster & Baldi claimed a solution of chromic acid, a reducing agent and a manganese compound,[219] and *electrolytic treatment* in solutions of chromic acid and boric acid or borates was disclosed by Wick & Schneidewind,[220] and Chester & Jeremias[221] divulged a solution of chromate, hydrochloric or nitric acid, a carboxylic acid and a reducing agent. Piccinelli went all the way by *first forming a phosphate coating* on the surface, dissolving it and then treating the freshly exposed iron base with a chromate solution,[222] which should dispel all doubts as to the type of coating the inventor favors.

Chromate baths containing fluoride were patented for *aluminum* by Ostrander & Congiundi,[223] Ostrander, Congiundi & Pocock,[224] and by Newhard & Carroll.[225] Cox & Hoover received one for *zinc,*[226] as did Van & Douty on a bath containing *chloride and fluoride,*[227] also Hartman on a bath containing borate.[228] Other patents included processes claimed by Chester, Jeremias & Irwin for *chromium plated zinc-copper alloys*[229] and for unplated alloys,[230] while Giesker & Britton obtained improved corrosion resistance on *chromium plated steel* by immersion in a solution of hexavalent chromium.[231]

To us, the most rewarding article on phosphate coating had nothing to do with the phosphate process itself. It was a study by Doss, McHenry & Eisler[232] of the effect of the subsequent *chromic acid rinse*. Employing radiophosphorus in their investigation, they found that high concentration of chromic acid results in significant removal of coating from thin films. For *heavier coatings*, 0.30 oz./gal. chromic acid in the rinse gave greatest protection. In another research, McNeill & Wick[233] found that the *protective value* of alkaline fluoride-phosphate anodize films on *magnesium* was improved by polyvalent metal anion additions. *Embrittlement* of phosphated high strength alloy steel may be prevented by aging 24 hours or baking at 220°F. for 1 hour, it was found by Weinberg & Capello.[234]

Informative articles were presented also by Heinzelman,[235] on the modern *chlorate-accelerated phosphating bath*, and by Gilbert[236] on the *function of accelerators*. Fishlock[237] reviewed the *theory and application* of phosphate coating, and Spring[238] gave details on composition, application, and chemical control of *zinc, manganese, and iron type baths*. Phosphating *formulations* were patented by Moore,[239] de-Pretto,[240] Ayres & Heinzelman[241] Somers & Rotsko,[242] and by Goodspeed & Pollard,[243] the last for coating *titanium and zirconium*. Other patents included *phosphating cleaners*, which contain solvents in addition to the phosphating chemicals, and were claimed by Copelin[244] and by Baecker, Kubis & Liger.[245] Also, *treating methods* were claimed by inventors, such as following the coating bath with a dip in a solution of chromic acid and a fluorine compound, disclosed by Carroll & Newhard,[246] and returning run-off to a chromic-phosphoric rinse after a subsequent rinse, divulged by Miles.[247] An unusual process, claimed by Ley, et. al.,[248] consisted of *forming an oxide on a surface*, which is reduced by heating in a reducing atmosphere, prior to phosphating.

*Electrolytic processes* were also subject to patent grants, Neish receiving one[249] for a *chromate-phosphate-solution* for steel, and McNeill for a *chromate-phosphate-fluoride bath* for magnesium.[250] Interesting, also, was the patent granted to Newhard[251] on a method of *replenishing* solutions for aluminum, using the weight loss upon immersion of a standard piece and type of glass to determine *fluoride additions*.

*Oxalate processes* appear to have interested a number of researchers, solutions being patented by Goodspeed & Gibson on a titanium accelerated bath,[252] by Rausch & Mayr[253] for a solution of oxalic acid containing fluoborate and chlorate, and by Wagner & Moeller[254] for the addition of a xanthate, thiourea and other materials. Oxalate conversion coatings specifically for *stainless steel* were claimed by Goodspeed & Dell,[255] who added a halide, thiocyanate and an organic nitro compound to the oxalic acid, and by Otto,[256] who employed an acid solution containing manganese oxalate and a sulfur-bearing compound.

The usual number of *hydrocarbon* and other *organic protective film-forming materials* were patented but, surprisingly, this year there was also an article on the subject, by Strong,[257] discussing the essential requirements of *temporary protective coatings* for metals. For those who might be interested in the patent grants, the references will be found at the end of this review.[258-70]

### *Testing and Control*

Three papers dealt with *acclerated corrosion tests*, which was one more than the previous year. Roden described a new *controlled moisture condensation apparatus* for humidity test,[271] while Quarendon detailed the *salt spray test* in one article[272] and surveyed *humidity tests* in another.[273] Other deposit tests received more attention. Raffalovich & Firestone presented a method of *detecting chemical protective films on aluminum*, using a stannic chloride drop test.[274] The *density and porosity* of anodic coatings on aluminum were determined by Mason,[275] applying Archimedes' principle with toluene as the liquid, and the use of the *interference microscope* for determining the *thickness* of the anodic film was detailed by Saur.[276] Other tests described were for *plated aluminum*, by Wernick & Pinner.[277]

A number of additional test methods were reported in the literature, including an *electronic thickness gauge*, concerning which Brodell & Brenner[278] de-described the circuit, calibration and characteristics, and an electrical apparatus for measuring *coating thickness on moving strip*, patented by Hags.[279] In a research report on the *effects of plating high strength steels*, Beck & Jankowsky[280] detailed a C-ring test which shows the susceptibility of stressed high strength steel to cracking after electroplating. Three new *plating test cells* came to light during the year, two of them suggested by Skwirzynski & Huttly[281] in the course of an investigation of cells, and the third in a patent granted to Hull & Winters,[282] which claimed a *cell for immersion directly into the plating bath* from the tank rod.

On the subject of plating solutions, Mohler discussed bath concentration units for *salt additions*[283] and the computations involved in working with *analytical factors*,[284] while an interesting group of new *analytical procedures* showed up in the literature. The popular reagent, EDTA, was reported suitable for the determination of *lead in fluoborate baths* by Gabrielson,[285] and for *iron in chromium solutions* by Dettner.[286] Chromium solutions were also represented by a method for *sulfate* which, according to Keattch, involved reduction to the sulfide, which is then determined volumetrically.[287] Two methods for determining *copper* were disclosed, an electrolytic one for copper in *cyanide solutions*, by Dow & Bakker,[288] and a colorimetric procedure for *nickel solutions*, for which Downey employed neo-cuproine as a reagent.[289]

Other methods consisted of a colorimetric determination of *nitrate in phosphating solution*, by Gilbert,[290] a photometric procedure for *molybdenum in cyanide zinc baths*, by Leftin,[291] a spectrophotometric method for *nickel in bright cadmium and gold solutions*, by Doherty,[292] and the assay of *tin and tin alloy baths* with the polarigraph, by Knotowicz & Petrocelli.[293] Since *waste treatment* is reviewed next, it is fitting to include here a qualitative test, suggested by Stevens & Lancy[294] for *detection of cyanide* in plating wastes down to 0.2 ppm, and *a spot test* with a limit of 1 ppm.

### *Waste Treatment*

Although descriptive articles were many, real developments were few. This, however, was to be expected since the fundamentals have been well established and only applications are being reported. *Plant designs and installations* were described by Davies,[295] by Stroh & Allen,[296] and by Hosman & Keating.[297] Securing *data for design of a system* was discussed by Glover,[298] *current trends* in waste treatment were detailed by Gurnham,[299] and the *use and handling of chemicals* employed for treatment was covered by Besselievre,[300] including the promising oxidant, ozone.

The whole field of waste treatment was surveyed by Serota, in a detailed series of articles.[301] *Ion-exchange* received its share of the attention, as usual. Bueltman[302] outlined the *theory and applications* and, together with Gough,[303] described *operating experience* with this method for *chromic acid recovery*. The *economics* of chromic acid recovery by ion-exchange vs. *destruction and replacement* were tabulated by Glover.[304] Lest one get the impression that this is the only method for recovering chromic acid, an article by Neben[305] described the employment of *evporation and concentration* of chromic wastes. *Cyanide disposal* was treated in two articles, one by Johnson,[306] disclosing results of an investigation of cyanide decomposition by *boiling with concentrated caustic soda*, which was found to be fairly rapid and cheap. The other article, by Hill & Neff, described an installation for *oxidation with chlorine*.[307]

*Pickling wastes* were the subject of one article and three patents. Howell discussed the *disposal* of waste pickle liquor after neutralization.[308] Bodamer & Horner[309] received a patent on *regeneration by diaphragm electrolysis* to plate out the dissolved iron, and Roy & Allen[310] precipitated calcium carbonate and ferrous sulfate, by *neutralizing with lime* and adding $CO_2$ and ammonia. A method which is receiving much attention by mills was described in a patent granted to Ruthner, in which a *closed pickling chamber* is used, the acid being recovered by *saturating with gaseous HCl* to precipitate ferrous chloride crystals, which are then heated to recover the HCl for reuse.[311]

### *Miscellaneous*

We know that much work has been done with *ultrasonics* but, unfortunately, very little has been published. Roll surveyed the work done on the effects on *electrodeposition*,[312] which indicated some advantages, none outstanding, and Rich[313] who studied this same subject, confirmed that the present applicability lies mainly in *cleaning and degreasing*, although some interesting results were obtained in electrodeposition. The developments in ultrasonics for cleaning and degreasing have been discussed in a previous section of this report.[13-15]

*Pretreatments* for obtaining *adhesion* were covered by three patents, to Utz[314] for *plating on beryllium* with a strike in a cobalt and ammonium sulfate bath, to Beuckman & Tucker[315] for *plating on titanium* by activating with stannous chloride and applying a chemically reduced copper film, followed by copper plating, and to Pearlman & Smith[316] for adherent *rhodium on carbon*. In connection with plating of *zinc-base die-castings*, Edwards[317] summarized published information and described some current investigations. Descriptive articles were presented by Horvick,[318-9] and by Ruegg.[320]

*Purification* of cyanide solutions was covered in two patents, one to Rinker[321] for the addition of a complex salt of *barium cyanide* and the metal to be deposited to remove undesired anions, and the other to Nobel & Ostrow[322] for the *addition of iodate* to oxidize sulfur in copper and silver baths. *Impurities* in cyanide solutions and their *effects* were described by Benner & Bair.[323]

Other miscellaneous items included a patent to Cape[324] for *removal of copper from iron* in nitric acid, using gold ions as inhibitor. Jorczyk described the *removal of stop-off coatings* with a modified solvent-vapor degreaser,[325] and the advantages of different types of *rack coatings* and *stop-offs* were discussed by Perez.[326] *Costs* were treated in two articles, a method of estimating standard costs in electroplating, by Alameda,[327] and a realistic approach to *barrel plating costs* by Ollard.[328]

The technical developments of the previous year were reviewed by Hall[329] and, in articles worthy of note, Day detailed the maintenance of *electrical equipment* in the plating room,[330] Fishlock discussed *fume exhausting*,[331] the calculation of proper *filter size* was presented by Gabrielson,[332] and Mohler showed how *centralized spray rinsing* could insure reproducible rinsing for non-routine or multi-purpose processing.[333] This author also compared *effective current density* with the theoretical.[334]

Spencer was responsible for two articles, one on corrosion-resistant *metals and alloys*,[335] and the other on finishing *springs*,[336] the latter including a discussion of *embrittlement* and the metallurgical aspects. Such also concerned himself with these aspects,[337] showing how the *physical properties of metals* are affected by changes in the properties of electrodeposits on these metals. *Printed circuit plating* and etching was the subject of articles by Shapiro[338] and by Foran.[339]

Among the miscellaneous patents, *automatic processing equipment* was disclosed by Davis,[340-1] by Cahn[342] by Stock and McLay,[343] and by Vrilakas & Vrilakas,[344] *Plating racks* were claimed by Novitsky[345] and by Monahan.[346] Other plating methods were patented by Topelian, who claimed the application of *porous, conductive fabric*, which is removed after plating,[347] and by Cohn[348] for a method of making continuous electrical contact on *slide fastener elements*.

Along *theoretical* lines, a half-dozen papers were worthy of note. A study of *concentration polarization* by O'Brien & Axon[349] showed three components of the film at working electrodes, and the *influence of periodic reverse current* on this type of polarization was studied by Hickling & Rothbaum.[350] A literature search on *microthrowing power* was compiled by Leffler & Leidheiser,[351] while Jelinek & David proposed a new direct method for expressing the results of *throwing power measurements* on plating solutions.[352] In other papers, Pavlopoulos & Strickland, who studied the *kinetics of metal deposition*, developed an equation which can be used to determine *limiting current density* during alloy formation,[353] and reported the *discharge characteristics* of metal deposition.[354]

The technical literature offered the usual number of pseudo-technical research papers, which concerned themselves with proprietary products and processes. Since the reported findings are not subject to verification, in most cases, but can only be considered claims, such reports are more properly in the realm of manufacturers' literature and do not fit into this survey.

### References


1. L. F. Spencer. Metal Finishing, **55**, 56 (Apr.).
2. J. B. Mohler. Metal Finishing, **55**, 57 (July).
3. L. Serota. Metal Finishing, **55**, 72 (Apr.).
4. L. Serota. Metal Finishing, **55**, 65 (May).
5. H. G. Webster. U. S. Pat. 2,801,215 (July 30).
5A. G. F. Carter. U. S. Pat. 2,796,366 (June 18).
6. J. A. Faler. U. S. Pat. 2,783,892 (Mar. 5).
7. J. A. Faler. U. S. Pat. 2,789,807 (Apr. 23).
8. R. Dunlevy & J. H. Shoemaker. U. S. Pat. 2,800,420 (July 23).
9. C. M. Brown. U. S. Pat. 2,803,596 (Aug. 20).
10. W. I. Phillips & J. C. Lawrence. U. S. Pat. 2,781,535 (Feb. 19).
11. E. R. Zademach. U. S. Pat. 2,800,995 (July 30).
12. J. A. Faler, G. W. Allen & R. H. Stanton. U. S. Pat. 2,815,614 (Dec. 10).
13. T. J. Bulat. Metal Finishing, **55**, 65 (Aug.).
14. G. G. Brown. U. S. Pat. 2,815,193 (Dec. 3).
15. T. J. Kearney. U. S. Pat. 2,802,476; 2,802,758 (Aug. 13).
16. C. E. Kircher. A.S.T.M. Bull., #219, 44.
17. C. E. Kircher. Metal Finishing, **55**, 63 (Dec.).
18. M. Randall. Metal Finishing, **55**, 60 (May).
19. D. Stewart. U. S. Pat. 2,787,596 (Apr. 2).
20. H. H. Jones & R. C. White. U. S. Reiss. Pat. 24,281 (Feb. 26).
21. I. L. Lans. U. S. Pat. 2,783,975 (Mar. 5).
22. R. W. Legler. U. S. Pat. 2,816,065 (Dec. 10).
23. T. J. Kearney. U. S. Pat. 2,808,064 (Oct. 1).
24. L. W. Snape. U. S. Pat. 2,788,540 (Apr. 16).
25. S. J. Oechsle, Jr. & K. G. LeFevre. Iron Age, **180**, 95 (July 11).
26. R. Haberl. U. S. Pat. 2,796,338 (June 18).
27. E. A. Sprigg & R. T. Venner, Jr. U. S. Pat. 2,792,671 (May 21).
28. W. H. Mead & A. A. Zambruno. U. S. Pat. 2,810,991 (Oct. 29).
29. A. J. Liebman. U. S. Pat. 2,782,564 (Feb. 26).
30. C. R. McKinsey, M. Stern & R. A. Perkins. A.S.M. Reprint #38.
31. H. L. Alexander & H. Farrel. U. S. Pat. 2,790,738 (Apr. 30).
32. J. J. Dailey. U. S. Pat. 2,780,594 (Feb. 5).
33. L. Missel. Metal Finishing, **55**, 46 (Sept.).
34. W. W. Sellers & C. B. Sanborn. 44th Proc. A.E.S., p. 36.
35. J. L. Collins. Prod. Fin., **21**, 43 (Feb.).
36. M. A. Streicher. U. S. Pat. 2,806,000 (Sept. 10).
37. H. R. Treece. U. S. Pat. 2,801,961 (Aug. 6).
38. G. H. Rohrback. U. S. Pat. 2,805,915 (Sept. 10).
39. G. S. Gardner & A. J. Saukaitis. U. S. Pat. 2,807,585 (Sept. 24).
40. K. F. Hager, J. H. Michel & M. Rosenthal. U. S. Pat. 2,801,979 (Aug. 6).
41. L. E. Samuels. J. Inst. Metals (Br.), **85**, 177.
42. L. E. Samuels. Electropl., **10**, 279, 315.
43. E. T. Candee & S. L. Henn. 44th Proc. A.E.S., p. 102.
44. L. F. Spencer. Metal Finishing, **55**, 50 (Mar.).
45. R. E. Paret. Mater. in Design Eng., **46**, 110 (Sept.).
46. R. S. Burt. Metal Finishing, **55**, 52 (Feb.).
47. T. J. Reid. Metal Finishing, **55**, 65 (Dec.).
48. W. K. Seward. Prod. Fin., **21**, 24 (July).
49. W. K. Seward. Plating, **44**, 43.
50. W. K. Seward. Prod. Fin., **21**, 36 (Jan.).
51. A. J. Jewis, U. S. Pat. 2,801,498 (Aug. 6).
52. A. J. Lewis III, U. S. Pat. 2,807,915 (Oct. 1).
53. J. B. Jones. U. S. Pat. 2,775,853 (Jan. 1).
54. L. Schaller. U. S. Pat. 2,791,070 (May 7).
55. W. E. Linden & W. E. Lennon. U. S. Pat. 2,802,311 (Aug. 13).
56. W. J. Cosmos. U. S. Pat. 2,778,166 (Jan. 22).
57. G. W. Johnson. U. S. Pat. 2,804,726 (Sept. 3).
58. A. Block. U. S. Pat. 2,802,315 (Aug. 13).
59. R. W. Bernstein & A. Block. U. S. Pat. 2,804,731 (Sept. 3).
60. G. G. Thomson & D. P. Latessa. U. S. Pat. 2,808,689 (Oct. 8).
61. J. J. Ballato. U.S. Pat. 2,816,402 (Dec. 17).
62. J. C. Wisnieski. U. S. Pat. 2,779,142 (Jan. 29).
63. A. S. Rock. U. S. Pat. 2,783,594 (Mar. 5).
64. F. E. Hendrickson. U. S. Pat. 2,785,516 (Mar. 19).
65. G. R. Churchill. U. S. Pat. 2,795,789 (June 18).
66. S. C. Mockiewicz. U. S. Pat. 2,803,096 (Aug. 20).
67. P. E. Schaffner. U. S. Pat. 2,805,530 (Sept. 10).
68. J. J. Lawler. U. S. Pat. 2,806,332 (Sept. 17).
69. R. O. Peterson. U. S. Pat. 2,816,403 (Dec. 17).
70. C. R. Housdorfer. U. S. Pat. 2,782,575 (Feb. 26).
71. A. T. Schofield. U. S. Pat. 2,789,302 (Apr. 23).
72. N. E. Nielson, U. S. Pat. 2,778,047 (Jan. 22).
73. B. E. Nelson. U. S. Pat. 2,789,303 (Apr. 23).
74. C. C. Kinker. U. S. Pat. 2,786,308 (Mar. 26).
75. A. F. von der Linden & S. Yacus. U. S. Pat. 2,815,609 (Dec. 10).
76. W. F. Diehl & R. D. Purcell. U. S. Pat. 2,803,093 (Aug. 20).
77. A. W. Brace. Metal Industry, **90**, 147.
78. A. W. Brace. Metallurgia, **55**, 173.
79. R. F. Ledford & J. F. Jumer. 44th Proc. A.E.S., p. 147.
80. W. A. Heinrich. U. S. Pat. 2,784,155 (Mar. 5).
81. S. Anzaldi. U. S. Pat. 2,803,595 (Aug. 20).
82. M. A. Treuhaft & C. E. Swanson. U. S. Pat. 2,782,160 (Feb. 19).
83. A. S. Kohler. Metal Finishing, **55**, 58 (Aug.); 59 (Sept.); 68 (Oct.).
84. L. F. Spencer. Metal Finishing, **55**, 48 (May).
85. C. J. Glasrud. Plating, **44**, 47.
86. R. W. Fitch. Prod. Fin., **22**, 28 (Oct.).
87. C. B. Schaefer & R. G. Messenger. Plating, **44**, 40.
88. C. J. Glasrud & F. E. Smith. Prod. Fin., **21**, 40 (May).
89. C. F. Gurnham. Prod. Fin., **21**, 48 (Mar.).
90. W. E. Brandt. Iron Age, **179**, 91 (June 20).
91. L. H. Hopewell. Plating, **44**, 36.
92. W. G. Heaphy. U. S. Pat. 2,809,473 (Oct. 15).
93. J. M. Andrus. 44th Proc. A.E.S., p. 143.
94. R. V. Vanden Berg. Met. Prod. Mfg., **14**, 42 (Aug.).
95. C. F. Nixon & H. A. Kahler. Plating, **44**, 156.
96. R. C. Spooner. 44th Proc. A.E.S., p. 132.
97. J. E. Bunch. Metal Finishing, **55**, 45 (July).
98. A. W. Sweet. Plating, **44**, 1191.
99. J. M. Kape. Metal Ind., **91**, 63, 90, 109, 129, 148, 171, 198, 217, 239.
100. C. Sonnino. U. S. Pat. 2,788,314 (Apr. 9).
101. P. Robinson. U. S. Pat. 2,798,037 (July 2).
102. C. J. Sobol. U. S. Pat. 2,778,790 (Jan. 22).
103. J. D. Patrick. U. S. Pat. 2,812,295 (Nov. 5).
104. C. Zickendraht & R. Wittwer. U. S. Pat. 2,814,576 (Nov. 26).
105. G. L. Cunningham & M. A. Levitin. U. S. Pat. 2,785,098 (Mar. 12).
106. T. J. Connor & R. Blumberg. U. S. Pat. 2,791,553 (May 7).
107. S. Wernick & R. Pinner. Metal Finishing, **55**, 61 (Feb.); 58 (Mar.); 68 (Apr.); 55 (May).
108. W. L. Aves, Jr. Plating, **44**, 1175.
109. H. Brown. U. S. Pat. 2,871,305-6 (Feb. 12); 2,795,540 (June 11); 2,800,440 (July 23); 2,800,442 (July 23). H. Brown & R. J. Clauss. U. S. Pat. 2,800,441 (July 23).
110. A. H. DuRose & J. D. Little. U. S. Pat. 2,782,152-5 (Feb. 19).
111. D. G. Ellis. U. S. Pat. 2,784,152 (Mar. 5).
112. J. L. Dye & O. J. Klingenmaier. J. Electrochem. Soc., **104**, 275.
113. I. R. Bellobono. Met. Fin. Journal (Br.), **3**, 5, 111.
114. J. Edwards. Electropl., **10**, 41.
115. A. J. Smith & R. Bacon. Plating, **44**, 186.
116. M. H. Jones, C. Y. Lu & J. Zajdowski. 44th Proc. A.E.S., p. 53.

117. J. J. Dale & H. K. Lutwak. Trans. Inst. Met. Fin., **34**, 133.
118. R. J. Runck. J. Electrochem. Soc., **104**, 74.
119. W. Cowle, D. E. Mansfield, P. Spiro & G. C. Wood. U. S. Pat. 2,802,779 (Aug. 13).
120. S. S. Frey. U. S. Pat. 2,780,591 (Feb. 5).
121. M. B. Hammond & G. B. Bowman. U. S. Pat. 2,776,255 (Jan. 1).
122. P. Talmey. U. S. Pat. 2,816,846 (Dec. 17).
123. C. G. Chambers & R. A. Spaulding. U. S. Pat. 2,791,516 (May 7).
124. C. H. deMinjer & A. Brenner. Plating, **44**, 1297.
125. A. W. Goldenstein, W. Rostoker & F. Schossberger. J. Electrochem. Soc., **104**, 104.
126. V. Royen. Electropl., **10**, 114.
127. M. V. Sullivan & J. H. Eigler. J. Electrochem. Soc., **104**, 226.
128. R. W. Powell. J. Inst. Metals (Br.), **85**, 185.
129. J. E. Hoover. Prod. Fin., **21**, 46 (Jan.).
130. L. Missel. Metal Finishing, **55**, 56 (Jan.).
131. J. B. Mohler. Metal Finishing, **55**, 75 (Dec.).
132. R. A. Hammond. Trans. Inst. Met. Fin., **34**, 83.
133. E. F. Osborn. U. S. Pat. 2,799,959 (July 23).
134. E. V. Berry. U. S. Pat. 2,782,159 (Feb. 19).
135. J. E. Stareck & R. Dow. U. S. Pat. 2,812,297 (Nov. 5).
136. M. R. Zell. U. S. Pat. 2,801,214 (July 30).
137. M. R. Zell. Metal Finishing, **55**, 57 (Jan.).
138. J. E. Stareck & R. Dow. U. S. Pat. 2,797,588-9 (Apr. 2).
139. J. E. Stareck, E. J. Seyb, Jr. & F. Passal. U. S. Pat. 2,800,436 (July 23).
140. J. E. Stareck & E. J. Seyb, Jr. U. S. Pat. 2,800,437-8 (July 23).
141. J. E. Stareck, E. J. Seyb, Jr. & F. Passal. U. S. Pat. 2,800,443 (July 23).
142. A. H. DuRose. U. S. Pat. 2,784,153 (Mar. 5).
143. T. C. Ovenston, C. A. Parker & A. E. Robinson. J. Electrochem. Soc., **104**, 607.
144. M. Suzuki. J. Inst. Metals (Br.), **85**, 206.
145. H. P. Rothbaum. J. Electrochem. Soc., **104**, 682.
146. D. E. Weimer. Trans. Inst. Met. Fin., **35**, 13.
147. M. Mercadov. Metal Ind., **90**, 27.
148. R. E. Woehrle & J. W. Condon. U. S. Pat. 2,799,634 (July 16).
149. M. Ceresa & R. E. Woehrle. U. S. Pat. 2,785,117 (Mar. 12).
150. D. R. France. U. S. Pat. 2,778,788 (Jan. 22).
151. L. B. Portzer & W. C. Leitenberger. U. S. Pat. 2,814,590 (Nov. 26).
152. B. D. Ostrow & F. I. Nobel. U. S. Pat. 2,809,929 (Oct. 15).
153. A. E. Cahill. 44th Proc. A.E.S., p. 130.
154. J. T. Owen. U. S. Pat. 2,801,935 (Aug. 6).
155. G. Grupp. Metal Finishing, **55**, 40 (July).
156. A. G. Russell. U. S. Pat. 2,816,066 (Dec. 10).
157. R. Seegmiller. U. S. Pat. 2,801,960 (Aug. 6).
158. E. C. Rinker. U. S. Pat. 2,799,633 (July 16).
159. F. Volk. U. S. Pat. 2,812,299 (Nov. 5).
160. J. Fischer & W. Schwarze. U. S. Pat. 2,800,439 (July 23).
161. I. J. Warwick. Prod. Fin. (Br.), **10**, 61 (Oct.).
162. E. R. Jorczyk. Metal Finishing, **55**, 46 (Mar.).
163. G. W. Slomin & M. P. Christensen. U. S. Pat. 2,798,843 (July 9).
164. R. Bayes, O. W. Langhans & L. Greenspan. U. S. Pat. 2,802,782 (Aug. 13).
165. B. D. Ostrow. U. S. Pat. 2,777,810 (Jan. 15).
166. O. Kardos. U. S. Pat. 2,807,576 (Sept. 24).
167. D. O. Walter. Electropl., **10**, 44.
168. R. H. Atkinson. U. S. Pat. 2,792,341 (May 14).
169. H. Strow. Prod. Fin., **21**, 24 (Mar.).
170. F. A. Lowenheim. 44th Proc. A.E.S., p. 42.
171. B. Cohen. Plating, **44**, 963.
172. J. Azzolino. Plating, **44**, 1180.
173. E. Heymann & G. Schmerling. U. S. Pat. 2,793,990 (May 28).
174. R. E. Shockley. U. S. Pat. 2,802,780 (Aug. 13).
175. H. J. West. Metal Finishing, **55**, 74 (Oct.).
176. H. J. West. Metal Finishing, **55**, 56 (Jan.).
177. E. W. Wolf. 44th Proc. A.E.S., p. 121.
178. F. W. Salt. U. S. Pat. 2,778,787 (Jan. 22).
179. S. C. Shome. Indian. Chem. Soc. J., **34**, 399.
180. R. H. Hardoen. U. S. Pat. 2,812,298 (Nov. 5).
181. V. Dress. Iron Age, **180**, 142 (Dec. 19).
182. L. B. High & W. E. Hague. U. S. Pat. 2,803,593 (Aug. 20).
183. J. B. Winters. U. S. Pat. 2,791,554 (May 6).
184. A. E. Chester & R. F. Main. U. S. Pat. 2,799,635 (July 16).
185. H. K. DeLong. U. S. Pat. 2,811,484 (Oct. 29).
186. J. Vaid & T. L. Rama Char. J. Electrochem. Soc., **104**, 282.
187. T. L. Rama Char. Electropl., **10**, 347.
188. C. F. Smart. U. S. Pat. 2,779,725 (Jan. 29).
189. A. H. DuRose. U. S. Pat. 2,801,959 (Aug. 6).
190. W. H. Safranek. U. S. Pat. 2,809,156 (Oct. 8).
191. F. E. Kendall & P. Golar. U. S. Pat. 2,813,804 (Nov. 19).
192. F. E. Kendall & H. A. Wagner. U. S. Pat. 2,813,805 (Nov. 19).
193. W. D. Buckingham. U. S. Pat. 2,794,775 (June 4).
194. J. A. Pope. Plating, **44**, 1291.
195. R. J. Bachman. Metal Prog., **72**, 88 (Nov.).
196. R. Goodman, V. Baptist & H. D. Rice. U. S. Pat. 2,793,989 (May 28).
197. G. Rosenqvist. U. S. Pat. 2,812,294 (Nov. 5).
198. K. P. Eulner & J. F. Mueller. U. S. Pat. 2,776,256 (Jan. 1).
199. R. C. Steffey. Metal Finishing, **55**, 56 (Nov.).
200. G. W. van Oosterhour & A. Bol. U. S. Pat. 2,776,915 (Jan. 8).
201. T. Nieter. U. S. Pat. 2,783,193 (Feb. 26).
202. H. R. Nack. U. S. Pat. 2,791,515 (May 7).
203. H. R. Nack, H. J. Homer & J. R. Whitacre. U. S. Pat. 2,812,272 (Nov. 5).
204. P. Pawlyk. U. S. Pat. 2,785,651 (Mar. 19).
205. B. Ostrofsky & J. W. Ballard. U. S. Pat. 2,790,731 (Apr. 30).
206. P. Alexander. U. S. Pat. 2,812,270 (Nov. 5).
207. R. B. Goodman. U. S. Pat. 2,804,397 (Aug. 27).
208. G. A. Samuel. U. S. Pat. 2,811,466 (Oct. 29).
209. G. Becker & F. Steinberg. U. S. 2,791,517 (May 7).
210. B. Ostrofsky & J. W. Ballard. U. S. Pat. 2,793,140 (May 21).
211. M. Hill. U. S. Pat. 2,783,164 (Feb. 26).
212. A. Hegarty. Met. Fin. Journ., **3**, 349.
213. P. J. Clough & P. Godley, II. U. S. Pat. 2,785,082 (Mar. 12).
214. L. Moles. U. S. Pat. 2,812,411 (Nov. 5).
215. R. J. Fabian. Mater. in Design Eng., **46**, 121 (Aug.).
216. M. Lewis. Met. Fin. Journ., **3**, 29.
217. C. W. Ostrander. Prod. Fin., **22**, 60 (Oct.)
218. W. E. Pocock. 44th Proc. A.E.S., p. 152.
219. L. K. Schuster & A. L. Baldi. U. S. Pat. 2,777,785 (Jan. 15).
220. R. M. Wick & R. Schneidewind. U. S. Pat. 2,780,592 (Feb. 5).
221. A. E. Chester & B. R. Jeremias. U. S. Pat. 2,796,372 (June 18).
222. A. Piccinelli. U. S. Pat. 2,800,422 (July 23).
223. C. W. Ostrander & N. R. Congiundi. U. S. Pat. 2,796,370 (June 18).
224. C. W. Ostrander, N. R. Congiundi & W. E. Pocock. U. S. Pat. 2,796,371 (June 18).
225. N. J. Newhard, Jr. & J. A. Carroll. U. S. Pat. 2,798,829-30 (July 9).
226. N. Cox & G. R. Hoover. U. S. Pat. 2,784,122 (Mar. 5).
227. L. Van & A. Douty. U. S. Pat. 2,786,002 (Mar. 19).
228. H. J. Hartman. U. S. Pat. 2,799,601 (July 16).
229. A. E. Chester, B. R. Jeremias & J. T. Irwin. U. S. Pat. 2,796,361 (June 18).
230. A. E. Chester, B. R. Jeremias & J. T. Irwin. U. S. Pat. 2,796,369 (June 18).
231. W. C. Giesker &R. K. Britton. U. S. Pat. 2,788,292 (Apr. 9).
232. J. Doss, W. D. McHenry & S. L. Eisler. Organic Finishing, **18**, 4 (Feb.).
233. W. H. McNeill & R. Wick. J. Electrochem. Soc., **104**, 356.
234. H. P. Weinberg & T. J. Capello. Metal Prog., **71**, 78 (Apr.).

235. E. Heinzelman, Jr. Metal Finishing, **55**, 61 (May).
236. L. O. Gilbert. 44th Proc. A.E.S., p. 73.
237. D. J. Fishlock. Prod. Fin. (Br.), **10**, 82 (Aug.).
238. S. Spring. Organic Finishing, **18**, 4 (Mar.).
239. H. R. Moore. U. S. Pat. 2,784,124 (Mar. 5).
240. E. dePretto. U. S. Pat. 2,787,565 (Apr. 2).
241. R. F. Ayres & E. Heinzelman, Jr. U. S. Pat. 2,790,740 (Apr. 30).
242. R. I. Somers & J. Rotsko. U. S. Pat. 2,813,812 (Nov. 19).
243. E. W. Goodspeed & F. G. Pollard. U. S. Pat. 2,813,814 (Nov. 19).
244. H. B. Copelin. U. S. Pat. 2,789,070 (Apr. 16).
245. H. J. Baecker, E. J. Kubis & A. W. Liger. U. S. Pat. 2,809,906 (Oct. 15).
246. J. A. Carroll & N. J. Newhard. U. S. Pat. 2,795,518 (June 11).
247. D. L. Miles. U. S. Pat. 2,813,815 (Nov. 19).
248. H. Ley, H. Keller, H. A. Kopp, W. Rausch & H. Fleischhauer. U. S. Pat. 2,813,813 (Nov. 19).
249. R. A. Neish. U. S. Pat. 2,812,296 (Nov. 5).
250. W. McNeill. U. S. Pat. 2,778,789 (Jan. 22).
251. N. J. Newhard, Jr. U. S. Pat. 2,814,577 (Nov. 26).
252. E. W. Goodspeed & R. C. Gibson. U. S. Pat. 2,785,097 (Mar. 12).
253. W. Rausch & A. Mayr. U. S. Pat. 2,791,525 (May 7).
254. E. Wagner & A. Moeller. U. S. Pat. 2,809,138 (Oct. 8).
255. E. W. Goodspeed & G. W. Dell. U. S. Pat. 2,800,421 (July 23).
256. G. Otto. U. S. Pat. 2,813,816 (Nov. 19).
257. E. Strong. Prod. Fin. (Br.), **10**, 79 (Jan.).
258. M. J. Shnitzler, T. P. Norton & R. McDonald. U. S. Pat. 2,776,917 (Jan. 8).
259. J. I. Wasson. U. S. Pat. 2,781,314 (Feb. 12).
260. M. DeGroote & J. P. Cheng. U. S. Pat. 2,781,352 (Feb. 12).
261. J. D. Oathout & R. W. Scott. U. S. Pat. 2,783,156 (Feb. 26).
262. J. P. McDermott. U. S. Pat. 2,783,202-4 (Feb. 26).
263. M. S. Baseman, K. S. Johnson & S. E. Baseman. U. S. Pat. 2,784,104 (Mar. 5).
264. L. W. Sproule & J. L. Tiedje. U. S. Pat. 2,791,510 (May 7).
265. E. P. Cunningham & D. W. Dinsmore. U. S. Pat. 2,794,782 (June 4).
266. E. A. Dieman & A. E. Brehm. U. S. Pat. 2,796,353 (June 18).
267. A. E. Brehm & A. W. Lindert. U. S. Pat. 2,796,408 (June 18).
268. W. B. Coleman & F. A. Goff. U. S. Pat. 2,811,456 (Oct. 29).
269. C. G. Harford. U. S. Pat. 2,816,051 (Dec. 10).
270. R. A. Westlund, Jr. & M. J. Furey. U. S. Pat. 2,816,842 (Dec. 17).
271. H. Roden. A.S.T.M. Bull., #223, 55 (July).
272. R. Quarendon. Prod. Fin. (Br.), **10**, 62 (Aug.).
273. R. Quarendon. Prod. Fin. (Br.), **10**, 70 (Nov.).
274. A. J. Raffalovich & S. Firestone. Metal Finishing, **55**, 65 (Apr.).
275. R. B. Mason. Metal Finishing, **55**, 55 (Aug.).
276. R. L. Saur. Plating, **44**, 1079.
277. S. Wernick & R. Pinner. Metal Finishing, **55**, 79 (June).
278. F. P. Brodell & A. Brenner. Plating, **44**, 591.
279. J. W. Hags. U. S. Pat. 2,793,345 (May 21).
280. W. Beck & E. J. Jankowsky. 44th Proc. A.E.S., p. 47.
281. J. K. Skwirzynski & M. Huttly. J. Electrochem. Soc., **104**, 650.
282. R. O. Hull & J. B. Winters. U. S. Pat. 2,801,963 (Aug. 6).
283. J. B. Mohler. Metal Finishing, **55**, 64 (Sept.).
284. J. B. Mohler. Metal Finishing, **55**, 66 (Feb.).
285. G. Gabrielson. Metal Finishing, **55**, 56 (Mar.).
286. H. W. Dettner. Metal Finishing, **55**, 67 (Feb.).
287. C. J. Keattch. Electropl., **10**, 2.
288. W. O. Dow, Jr. & G. Bakker. Plating, **44**, 969.
289. T. A. Downey. Plating, **44**, 383.
290. L. O. Gilbert. Metal Finishing, **55**, 66 (Apr.).
291. J. P. Leftin. Plating, **44**, 380.
292. N. F. Doherty. Plating, **44**, 971.
293. A. E. Knotowicz & J. V. Petrocelli. Plating, **44**, 602.
294. W. F. Stevens & L. E. Lancy. 44th Proc. A.E.S., p. 70.
295. L. Davies. Sewage & Ind. Wastes, **29**, 1024.
296. J. Stroh & C. Allen. Plating, **44**, 869.
297. L. J. Hosman & R. J. Keating. Sewage & Ind. Wastes, **29**, 34.
298. G. E. Glover. Prod. Fin., **21**, 60 (Sept.).
299. C. F. Gurnham. Plating, **44**, 873.
300. E. B. Besselievre. Sewage & Ind. Wastes, **29**, 1252.
301. L. Serota. Metal Finishing, **55**, 88 (June); 50 (July); 69 (Aug.); 65 (Sept.); 75 (Oct.); 72 (Nov.); 77 (Dec.).
302. C. G. Bueltman. Sewage & Ind. Wastes, **29**, 1018.
303. C. L. Gough & C. B. Bueltman. Plating, **44**, 879.
304. G. E. Glover. Plating, **44**, 161.
305. E. W. Neben. Plating, **44**, 52.
306. D. R. Johnson. Metal Finishing, **55**, 85 (June).
307. E. A. Hill & F. J. Neff. Plating, **44**, 864.
308. G. A. Howell. Sewage & Ind. Wastes, **29**, 1278.
309. G. W. Bodamer & C. Horner. U. S. Pat. 2,810,686 (Oct. 22).
310. T. K. Roy & L. N. Allen, Jr. U. S. Pat. 2,798,802 (July 9).
311. O. Ruthner. U. S. Pat. 2,785,999 (Mar. 19).
312. A. Roll. Metal Finishing, **55**, 55 (Sept.).
313. S. R. Rich. 44th Proc. A.E.S., p. 87.
314. J. J. Utz. U. S. Pat. 2,798,036 (July 2).
315. F. O. Beuckman & W. M. Tucker. U. S. Pat. 2,801,213 (July 30).
316. H. Pearlman & C. A. Smith. U. S. Pat. 2,778,786 (Jan. 22).
317. J. Edwards. Metal Ind., **90**, 547.
318. E. W. Horvick. Metal Finishing, **55**, 52B (Jan.).
319. E. W. Horvick. Met. Prod. Mfg., **14**, 68 (Apr.); 59 (May); 64 (June).
320. W. Ruegg. Metal Ind., **91**, 333, 375, 422.
321. E. C. Rinker. U. S. Pat. 2,787,590 (Apr. 2).
322. F. I. Nobel & B. D. Ostrow. U. S. Pat. 2,783,194 (Feb. 26).
323. H. L. Benner & R. R. Bair. Plating, **44**, 151.
324. A. T. Cape. U. S. Pat. 2,779,674 (Jan. 29).
325. E. R. Jorczyk. Metal Finishing, **55**, 63 (Oct.).
326. M. Perez. Metal Finishing, **55**, 62 (Apr.).
327. J. M. Alameda. Electropl., **10**, 213.
328. E. A. Ollard. Met. Fin. Journ., **3**, 13.
329. N. Hall, Metal Finishing, **55**, 42 (Jan.).
330. J. P. Day. Metal Finishing, **55**, 65 (Oct.).
331. D. J. Fishlock. Electropl., **10**, 103, 184.
332. G. Gabrielson. Metal Finishing, **55**, 50 (July).
333. J. B. Mohler. Metal Finishing, **55**, 68 (Aug.).
334. J. B. Mohler. Metal Finishing, **55**, 71 (Nov.).
335. L. F. Spencer. Metal Finishing, **55**, 58 (Oct.); 62 (Nov.).
336. L. F. Spencer. Metal Finishing, **55**, 56 (Dec.).
337. T. E. Such. Metallurgia (Br.), **56**, 61 (Aug.).
338. H. Shapiro. Plating, **44**, 607.
339. N. Foran. Plating, **44**, 1071.
340. J. V. Davis. U. S. Pat. 2,780,229 (Feb. 5).
341. J. V. Davis. U. S. Pat. 2,789,569 (Apr. 23).
342. K. Cahn. U. S. Pat. 2,792,809 (May 21).
343. R. J. Stock & J. McLay. U. S. Pat. 2,793,993 (May 28).
344. M. Vrilakas & J. Vrilakas. U. S. Pat. 2,810,691 (Oct. 22).
345. J. Novitsky. U. S. Pat. 2,793,994 (May 28).
346. J. J. Monahan. U. S. Pat. 2,801,965 (Aug. 6).
347. P. J. Topelian. U. S. Pat. 2,784,151 (Mar. 5).
348. C. C. Cohn. U. S. Pat. 2,790,756 (Apr. 30).
349. R. N. O'Brien & H. J. Axon. Trans. Inst. Met. Fin., **34**, 41.
350. A. Hickling & H. P. Rothbaum. Trans. Inst. Met. Fin., **34**, 53.
351. E. B. Leffler & H. Leidheiser, Jr. Plating, **44**, 388.
352. R. V. Jelinek &H. F. David. J. Electrochem. Soc., **104**, 279.
353. T. Pavlopoulos & J. D. Strickland. J. Electrochem. Soc., **104**, 116.
354. T. Pavlopoulos & J. D. Strickland. J. Electrochem. Soc., **104**, 568.

# Organic Finishing Developments of 1957

By Daniel A. Marino, *Asst. Technical Editor*

### *Introduction*

THE field of organic finishing saw a number of accomplishments in 1957, both in the development of new and improved coatings as well as in the more efficient and rapid methods of application. Expansion of facilities for increasing both the quantity and quality of organic finishing materials has kept pace with the increase in sales of the materials. More experience with vinyls,[1] epoxies,[2,3,4,5,6,7] and polyurethanes[8] has shown that although many of the highly optimistic early claims for these materials have not been realized, modifications of some formulations containing them will undoubtedly gain widespread application.

The various methods of applying paint to products continue to compete with one another. While the brushing technique has all but been abandoned in favor of methods which more easily adapt themselves to automation, the bulk of manufactured items continue to receive individual attention in the paint room. Hand operated air spraying though, in a number of instances, is being replaced by electrostatic,[9-19] airless,[20-23] and steam spraying,[24] still accounts for applying the largest share of industrial paint finish.

Steam spraying and hot spraying, roller, dip and flow coating continued to grow in importance in 1957; more recent airless spraying methods attracted much attention. Work is now in progress which may completely eliminate the need for air, both as a means for paint atomization and to maintain a paint pressure head.[21] It is based on the assumption that the heat vaporization of the finishing material itself will provide the necessary particles propulsion for spraying.

Because automation of production activities has been much of industry's ultimate goal, it is natural that those coating application methods which most readily adapt themselves to rapid assembly line techniques will be in greatest demand. Electrostatic spraying and flow coating have, therefore, been carefully investigated and, because of the various improvements both in equipment and technical know-how in 1957, the range of both methods has been significantly extended.

Dr. Albert C. Zettlemoyer,[25] who presented the Joseph J. Mattiello Memorial Lecture at the 35th Annual Meeting of Federation of Paint and Varnish Production Clubs in Philadelphia, indicated that the tremendous importance of the nature of the interface during the manufacture of dispersions, during their application, and in performance of the finished coatings is being uncovered. He predicted that progress in the coating industry is very likely to come from a greater understanding and control of the pigment-vehicle interface. He further forecast that the time will come when the pigment will be engineered to combine much more tightly with vehicle components than usually occurs now. Chemical binding of the surface may be the answer.

### *Properties of Organic Finishing Materials and Coatings*

Cationic surfactants[26] are becoming increasingly recognized as valuable aids in promoting the adhesion of paints under adverse conditions; particularly where surface dampness is encountered. In the presence of moisture the condition of a cationic agent to a paint will make the surface more positive by alteration of the zeta potential, whereas the surface to be coated will usually be associated with a negative charge. Under these conditions the water interface will be displaced and adhesion will result where it would otherwise not be possible.

Antistatic agents[26] are being considered for incorporation in paints, particularly of the cationic type, with a view to increasing the conductivity of the paint surface. If the problem is solved, dust attraction to painted surfaces will not occur.

An elaborate study made by Taylor and Zettlemoyer[27] indicates that an accurate assessment of the operating efficiency of a given pigment mill is feasible. With current rising costs of paint manufacturing, it is especially important to properly evaluate the grinding required and carry out an operation that will require a minimum amount of time and power.[28]

Heiberger[29] pointed out that increasing the amount of toxicant preservatives in a paint over a critical value is often a valueless and dangerous procedure since it may lead to development of resistant strains and subsequent increase in mold growth.

A new approach[30] for determining hiding power of glossy films is suggested which requires application of the Kubelka-Munk two constant theory of light scattering. Since it is not necessary to measure film thickness for utilizing this method, a considerable time and labor savings is indicated.[31,32]

Economy conscious paint manufacturers will profit by a statement made by F. B. Stieg, Jr.[33] that, under certain circumstances, the further addition of titanium dioxide per gallon may produce *less* hiding power. He explains this by showing that the hiding power is greatest when the individual titanium dioxide par-

ticle is separated from the next particle in the paint film by a distance equivalent to at least its own diameter. Addition of more pigment will bring the particles so close that they behave optically as though they were a single large particle.

Since pigment properties such as texture, particle size distribution and hardness are of considerable importance when formulating finishes based on polyester resins Heinle[31] advocates that the pigment products be spread as thin films on glass and be tested with the Konig pendulum hardness tester.

### *Progress in Materials*

The Illinois legislature has approved a bill which requires precautionary labels on containers of paints having more than one per cent lead. The new law which goes into effect July 1, 1958 is similar to New York City's which has been in effect since 1955.

Epoxy resins[2,3] have continued to gain in importance as materials for organic finishes. Although their properties of superior adhesion, flexibility and chemical inertness are finding ever increasing number of uses in the field, their relatively high cost continues to retard an even greater increase of popularity. The increased uses have, however, stimulated research activity to find causes for various failures in application and in service. Swift[7] has shown that "gas checking," one of the more serious problems encountered in application of baking epoxies, is to some extent controlled by addition of a curing agent with a suitable solvent.

Barium is in many cases replacing lead as a promoter drier for cobalt. Zirconium and vanadium compounds, as pointed out by Professor Bawn,[34] are also gaining in popularity. In unsaturated polyester styrene systems, vanadium shows a remarkable speeding of gelling time compared with cobalt, i.e., five minutes for vanadium, twenty-three minutes for direct metal reaction cobalt and twenty-nine minutes for double decomposition cobalt.

Polyamide resins are providing the basis for (thixotropic) paints which do not drip, which are virtually sag-proof when applied to a vertical surface and which are free from the nuisance of pigment settling.[2]

Polyurethane coatings,[8] after experiencing success in Germany for a number of years, have made significant inroads in the United States' coatings fields during the last year. Even though these coatings harden at room temperature, because of the care with which they must be applied at present more developmental work will probably be necessary before full acceptance will be established.

H. W. Chatfield[6] revealed how investigation of epoxidized oils (unsaturated vegetable oils in which the double bond has been replaced by an epoxy group) led to a more stable chlorine-containing copolymer, organic acid oils and alkyd resins of low free acidity. Epoxidized oils exert a measurable control over the reaction between aluminum powder and the medium.

Fine suspensions of a vinyl resin in a solution of an alkyd are being used as a basis for hard, durable wrinkle finishes of uniform texture.

A method was described by R. A. Cass[35] which utilizes polytetrafluorethylene sheets as a substrate for casting paint films. The method has been successfully used for casting free films of alkyds, styrenated alkyds and baking finishes.

Teel[36] showed that anti-fouling protection with coal tar coatings could be obtained by using a material of the following composition: 45% pitch, 30% rosin, and 25% xylol by weight with 6 pounds of copper powder per gallon.

Although not yet available in all colors, push-on coatings[37] have served important maintenance functions. The coatings, which consist of organic sheet materials with built-in binding media, have been found to be particularly useful where extra-thick and unusually durable finishes are needed.

Aluminum paints formulated with a silicone resin base are rapidly gaining importance as heat resistant coatings.[38]

### *Corrosion and Organic Finishes*

The results of a study[39] made by the American Zinc Institute show that with the combination of organic paint and cathodic protection, as from impressed current or galvanic anodes, the electrical resistance of the paint coat is adversely affected; also, the tendency of the paint coat to absorb water and oxygen is increased. The more intense the electrical current which has been imposed on the structure, the more drastic is the action. Controling paint formulation and/or intensity of electrical current impressed on the structure being protected, is a suggested means of reducing premature failure.

Phosphate and chromate conversion coatings as metal conditioners prior to organic coating continued to receive extensive popularity in the technical literature.[40-43] Chlorate-accelerated phosphate baths[42] were found to have, under certain conditions, superior corrosion resistant properties to the more commonly used phosphate baths. Variations of the more popular formulae and some completely new types have been reported.[44-54]

An extensive evaluation of chromate pigments made by the U. S. Army[55] indicates that more selective application of such pigments will materially improve the corrosion resistance of metal so coated. Suggestion is made that an "all-purpose" chromate pigment primer may eliminate the need for a special primer for steel, aluminum, magnesium, etc.

### *Water Base Paints*

Water base paints continue to increase in popularity.[56-61] Prentiss found that the performance of a latex paint depends heavily upon the manner in which the pigments are distributed. Since well distributed pigment improves the material enormously, careful use of a proper dispersion is often many times repaid in high quality material.[62]

Since little or no fire hazards exist where water base paints are produced or applied, fire insurance companies have shown a great interest in such coatings. Chicago paint manufacturers, according to J. W. Tomecko, are now facing a situation where they may only be permitted to manufacture water-type paints in that area. He also feels that we are on the brink of a revolution when water emulsion paints come

into their own for the painting of metal, wood and all types of surfaces. Much of the available literature concerning testing of latex-type vehicles published during 1957 tend to bear out Dr. Tomecko's feelings.[61, 62]

### *Miscellaneous*

Quality inspection and evaluation of organic coatings continued to attract attention. Statistical quality control method for organic finishing was shown by Dr. H. Wagner[63, 64] to present a useful tool for the coating processor.[65]

An interesting compilation [66] of reclaimation procedures for off-quality "in-process" paint batches was described by the Montreal Paint and Varnish Production Club. The report resulted from information supplied by paint manufacturers in a questionnaire sent to them the previous year.

Attesting to the rapid growth of vacuum coating in the United States was the launching of a society[67] consisting of those engaged in allied fields of the industry in Cleveland, on October 30, 1957. The organization, called "Society of Vacuum Coaters," may in time provide an effective medium for coordinating the activities of its growing body of members. Organic finishes, which are important materials for many of the more common vacuum coating cycles, should experience parallel activity with the growth of this coating method.

A nomograph[68] for determining conveniently the "comparable cost" for paints or coating materials was described by Volkening and Wilson.[68, 69] The price based on volume measure, the "comparable cost," is based on the solids concentration per gallon.

In a report[70] of the U. S. Naval Gun Factory, it is revealed that both sparks and impacts can result from the use of "non-sparking" materials. This apparent reversal of contemporary thinking invites more serious concern for those people engaged in the production and application of highly flammable materials. The authors conclude with the ominous note that no benefit is gained by employing non-sparking hand tools in place of steel to prevent explosions.

### *Bibliography*


1. "Vinyl-Alkyd Wrinkle Finish." British Pat. 734,664. *Paint Tech.* Vol. 21, No. 237, 215 (1957).
2. David Glaser, F. Don, H. Wittcoff, *Off. Digest*, Feb. 1957, 159-169.
3. L. R. Barakan, "Epoxy Resins in Surface Coatings," *Paint Manufacture*, Aug., 1957, 308-313.
4. J. Delmonte, "Electrical and Mechanical Properties of Epoxy Plastics," *ASTM Bulletin*, Sept. 1957, 32-35.
5. E. F. H. Strauss, "Better Appliance Finishes by Flow Coating with Epoxies," *Organic Finishing*, Sept. 1957, 15-18.
6. H. W. Chatfield, *Paint Manufacture*, Feb. 1957, 51-54.
7. G. Swift and R. E. Stolton, *Off. Digest*, July 1957, 664-683.
8. H. B. Wagner, "Urethane Coatings — Tough But Temperamental" *Organic Finishing*, Sept. 1957, 8-11.
9. J. W. Juvinal, U.S. Pat. No. 2,759,763.
10. J. W. Juvinal, U.S. Pat. No. 2,764,125.
11. J. W. Juvinal, U.S. Pat. No. 2,764,712.
12. L. J. Lamm, U.S. Pat. No. 2,773,472.
13. R. C. Juvinal, U.S. Pat. No. 2,780,565.
14. M. R. Miller, U.S. Pat. No. 2,781,279
15. J. Sedlacsik, U.S. Pat. No. 2,782,074.
16. E. P. Miller, U.S. Pat. No. 2,781,282.
17. E. M. Ransburg, U.S. Pat. No. 2,785,088.
18. E. S. Beck, "Electrostatic Application," Part I. *Organic Finishing*, July 1957, 8-11.
19. E. S. Beck, "Electrostatic Application," Part II. *Organic Finishing*, Aug. 1957, 8-11.
20. "Airless Spray," *Trans. Inst. Met. Finishing*, 1957, 34 (British).
21. J. Starr, "Improved Airless Spray Equipment," *Organic Finishing*, Feb. 1957, 7-8.
22. J. Starr, "New Airless Finishing Method," *Organic Finishing*, June 1957, 4-6.
23. "Airless Spray," *Paint Man.*, June 1957, 225-226.
24. H. B. Wagner, "'Steam-Spraying' Expands the Paint Dollar," *Organic Finishing*, Aug. 1957, 4-7.
25. A. C. Zettlemoyer, Joseph J. Mattiello Memorial Lecture, 35th Annual Meeting, Fed. of Paint & Varnish Production Clubs.
26. C. D. Moore and Maurice Bell, *Paint Tech.*, June 1957, 199.
27. L. R. Barakan, *Paint Man.*, Aug. 1957, 299-304, 319.
28. C. P. Baker & P. Virtue, *Off. Digest*, Feb. 1957, 178-187.
29. P. Heiberger, *Off. Digest*, Feb. 1957, 100-157.
30. F. Munk, *Paint Man.*, June 1957, 217-222.
31. Heinle, Deutsche Farben Z., 1956, 10 (12) 462.
32. P. B. Mitton, *Off. Digest*, Feb. 1957, 188-201.
33. F. B. Stieg, Jr., *Off. Digest*, May 1957.
34. Biennial Conference of the Oil & Colour Chemists Assoc., England.
35. R. A. Cass, *Off. Digest*, March 1957, 240-242.
36. R. B. Teel and W. F. Fair, Jr., *Corrosion* 13, No. 8, 19 (1957).
37. J. Starr, "Push-On Coatings," *Organic Finishing*, Feb. 1957, 15-16
38. P. A. J. Gate, *Trans. Inst. Met. Finishing*, 1957, 34, 18-27 (British).
39. A. C. Elm, *Off. Digest*, Apr. 1957, 351-370.
40. J. Doss, W. D. McHenry, S. L. Eisler, *Organic Finishing*, Feb. 1957, 4-8.
41. H. E. Patterson, *Corrosion*, Jan. 1957, 77-84.
42. E. Heinzelman, Jr., *Organic Finishing*, May 1957, 8-11.
43. H. Ley, W. Stenger, W. Werner & K. Lampatzer, U.S. Pat. 2,758,949.
44. R. I. Somers, U.S. Pat. No. 2,762,732.
45. L. K. Schuster & A. L. Baldi, Jr., U.S. Pat. No. 2,768,103.
46. L. K. Schuster & A. L. Baldi, Jr., U.S. Pat. No. 2,768,104.
47. E. W. Goodspeed & R. C. Gibson, U.S. Pat. No. 2,785,097.
48. L. Van & A. Douty, U.S. Pat. No. 2,786,002.
49. E. de Pretto, U.S. Pat. 2,787,565.
50. H. B. Copelin, U.S. Pat. No. 2,789,070.
51. R. F. Ayres & E. Heinzelman, Jr., U.S. Pat. No. 2,790,740.
52. W. Rausch & A. Mayr, U.S. Pat. No. 2,791,525
53. N. D. Allwine, U.S. Army Corps of Engineers, Ft. Belvoir, Va.
54. P. F. Sanders, U.S. Pat. 2,787,603.
55. J. Dazzi, U.S. Pat. No. 2,786,040.
56. G. A. Basedon, *Jour. of Oil & Color Chem. Assoc.*, 40, (37) 1957.
57. H. W. Chatfield, *Paint Man.*, Oct. 1957, 386-389.
58. V. M. Willis, U.S. Pat. 2,773,849.
59. V. M. Willis, U.S. Pat. 2,773,850.
60. F. Liberti, *Off. Digest*, June 1957.
61. J. W. Tomecko, *Off. Digest*, June 1957.
62. W. C. Prentiss, *Off. Digest*, Oct. 1957.
63. H. B. Wagner, *Organic Finishing*, Apr. 1957, 8-12.
64. H. B. Wagner, *Organic Finishing*, May 1957, 4-7.
65. F. E. Kulmon, "Coating Resistance Conforms to Probability Law," *Corrosion*, 13, 9 (1957).
66. H. Kredentser, S. E. Bertsch, H. Kraus, E. Pyres, & A. Shore, *Off. Digest*, July 1957.
67. Society of Vacuum Coaters Proceedings, Oct 1957.
68. V. B. Volkening & J. T. Wilson, Jr., *Chem. Engineering*, 63, No. 8, 248 (1956).
69. V. B. Volkening & J. T. Wilson, Jr., *Corrosion*, 13, No. 8, 33 (1957).
70. H. Bernstein & G. C. Young, U.S. Naval Gun Factory, Wash., D. C., April 1957, PB 131131.

# FIRM ADHERENT PLATING FOR ALUMINUM

By J. C. Withers and P. E. Ritt, *Melpar, Inc., Falls Church, Va.*

***Abstract***

A new method of obtaining electrodeposits on aluminum with excellent adhesion has been developed. This method consists of producing a thin coating of nickel on the surface of the aluminum, then heat treating the nickel-clad aluminum, which forms a suitable base upon which any subsequent metal can be plated with perfect adhesion. The details of the process are discussed herein.

***Introduction***

Since the applications of electroplated aluminum are manifold and continually increasing, a great deal of interest has been created in the development of methods for plating on aluminum. Some of the applications for metallic coatings on aluminum are to decrease contact resistance, to improve surface conductivity, to improve solderability, to reduce friction, to facilitate the bonding of rubber, and to increase wear resistance.

Decorative finishes on aluminum have found wide usage in household appliances and in the jewelry industry. In general, plated aluminum of good quality has found wide application in all industries because of its relative economy, attractive finish, strength, and lightness.

The plating of aluminum can generally be divided into two broad categories. The first is chemical etching, in which the aluminum article is chemically-etched and a subsequent metal is deposited on the conditioned surface either by immersion or by electrodeposition. The second, which is of no concern here, includes the various anodizing processes which produce an oxide coating upon which subsequent metals can be deposited. Of the different methods of plating on aluminum, only a few procedures have merit. Most give only fair results or are impractical or uneconomical.

One of the most practical and economically-sound methods of plating on aluminum is, categorically, a chemical-etching process. Various degrees of the chemical-etching process are used more often throughout industry than any other process because of the low-operating cost of the etch bath as compared to the high power cost for operating anodizing baths. The method used and explained herein consists of chemically-etching and then electrodepositing nickel on the aluminum.

***Experimental***

Several methods of plating on aluminum were evaluated to determine the best technique for obtaining good adhesion between the plated metal and the aluminum. One of the first methods approached was the familiar zincate. In the hands of those who are skilled in the art of plating on aluminum, the process works with good success; however, in production-type operations, the process is not consistent because of the different procedures and the high degree of skill that must be utilized when the different alloys of aluminum are encountered.

A modification of the zincate method was investigated and found to give more consistent results. This procedure consists of the standard process for cleaning aluminum ,i.e., degrease, alkaline etch, and deoxidize. After the deoxidation treatment, the aluminum article is given a dip in fluoboric acid. A thin film of zinc is then electrodeposited on the aluminum from a standard alkaline zinc bath. An improvement over the normal zincate procedure was observed; however, the procedure did not fulfill the requirements of consistent firm adhesion and suitability for production processing.

Since none of the methods investigated, using zinc as an intermediate coating between aluminum and subsequent electrodeposits, gave the results desired, further investigation was carried out. This led to the use of a method developed in Cambridge, England, by *Dr. J. M. Bryan*. It consisted of placing the aluminum article in an etch which consisted of dextrin, water, and trichloracetic acid, rinsing in acetone, and plating nickel on the etched surface from a nickel sulfate bath. Dr. Bryan's procedure was found to be an improvement over the zinc coating methods; but, because of the high cost of the etch bath and, in some cases, the poor adhesion of the nickel to the aluminum, the process was not accepted as the best. However, there were some alternate procedures developed from this method which later led to the development of the present process. It was found that, after etching, tin, rhodium, and chromium could be plated directly on the etched surface of the aluminum just as the nickel had been plated in other instances. The plated metals of the pieces processed appeared to have good adhesion to the aluminum.

Although this alternative process offered some satisfaction, it was felt that further improvement in the adhesion characteristic of the plating could be obtained if the deposited metal were fused with the aluminum. To accomplish this fusing operation, the plated aluminum was subjected to a furnace temperature of 800°F. to 1050°F. for five minutes. As an example, nickel

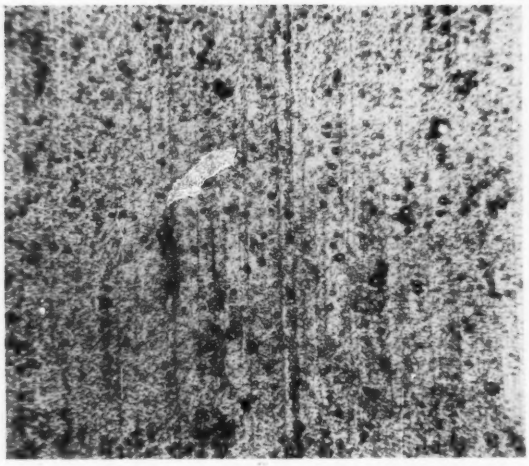


Fig. 1. Nickel-flashed aluminum as plated before heat-treating (1000X).

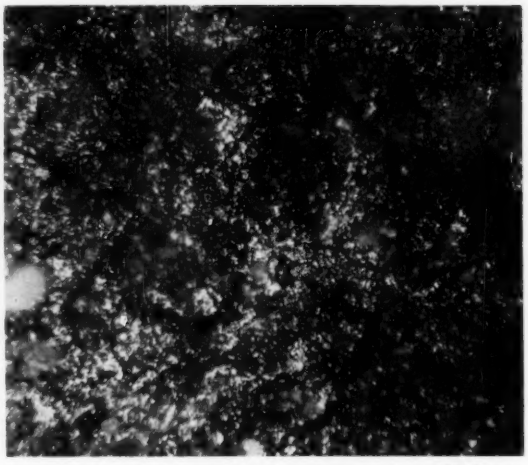


Fig. 2. Nickel-flashed aluminum after heat-treating at 900°F. for 4 minutes (1000X).

could be the plated metal and the aluminum prepared and processed by the following operations:

1. Degrease.
2. Etch.
3. Nickel strike 0.0001" to 0.0005" thick.
4. Heat treat at a furnace temperature of 800-1050°F. for approximately five minutes. The temperature depends up the aluminum alloy.
5. Clean.
6. Plate any desired metal.

The degreasing step removes oils and organic contamination on the surface of the aluminum. This may be accomplished by vapor degreasing or by soaking the aluminum in any solvent ordinarily used for this process.

The etching operation involves the use of two types of etches. The aluminum article is first etched in a 10% by volume solution of hydrofluoric acid (48-52%) for 10 to 15 seconds. The article is then rinsed and transferred to a second etch of 50% hydrochloric acid containing 9 to 10 g/l of manganous sulfate ($MnSO_4.H_2O$). The etching time varies from 10 to 80 seconds, depending upon the aluminum alloy.

For the light alloys of aluminum, an etching time of 20 to 30 seconds is usually sufficient. For some die and sand castings, a more severe etch than hydrofluoric acid and water may be needed. In such cases, an etch which consists of 3 parts of nitric acid and one part of hydrofluoric acid may be substituted. After the aluminum article has been given the two etching treatments, it is dip rinsed and transferred to the nickel bath.

The nickel plate is obtained from a nickel bath of the following composition:

| | | |
|---|---|---|
| Nickel sulfate ($NiSO_4.6H_2O$) | 19 | oz./gal. |
| Magnesium sulfate ($MgSO_4.7H_2O$) | 10 | " " |
| Ammonium chloride | 2 | " " |
| Boric acid | 2 | " " |

The aluminum article is made the cathode and plated at 15 amp./sq.ft. for approximately 10 minutes to obtain the desired thickness of the nickel plate which ranges from 0.0001" to 0.0005" thick.

It is presumed that during the heat-treating process some of the nickel diffuses into the aluminum and, because of the high surface energy of the nickel, readily agglomerates into islands. The temperature during the heat treatment should be between 800-1050°F. for the islands to form. Several temperatures were investigated to determine at which point the islands would form. Since each different alloy of aluminum will have a different melting point and will, therefore, form islands at different temperature, it was found that the islands always form when the temperature range is 800-1050°F. Figures 1 and 2 show the difference in the surface of the nickel-plated aluminum before and after heat treating.

The formation of the aluminum nickel alloy and the formation of the islands provides a suitable surface upon which other metals may be electrodeposited. Metals plated on this surface have improved adhesion around the regions of the islands. However, if the heat treatment is carried out in air, a thin layer of oxide is formed on the surface of the article. Before subsequent plating can be accomplished, the oxide must be removed by giving the article a reverse current treatment in 25% sulfuric acid solution. If the nickel-plated aluminum is heat treated in the non-oxidizing atmosphere, oxidization is minimized and the article need only be dipped in a 25% sulfuric acid solution for a few seconds to activate the surface before subsequent plating is carried out.

If the time in the hydrochloric acid etch is controlled very closely with each different type of alloy used, the heat treatment step may be omitted and fair adhesion of the nickel and aluminum will be obtained. It was found that with 24ST aluminum good adhesion could be obtained using an etch time of 18-22 seconds. However, if the best adhesion is to be obtained in every case and, if the process is to be reproducible, the heat treatment step is essential.

*(Continued on page 57)*

# Electroplating 22 Karat Gold-Silver Alloy

By R. E. Harr and A. G. Cafferty, *Western Electric Company, Inc., Chicago, Ill.*

OPERATION of electrical contacts is generally enhanced by wiping action that is conducive to self-cleaning. However, this desirable action may be nullified if the contacts are operated at low pressures and frequencies. In such a case a gold alloy having a composition of 8% silver, corresponding to 22 carat gold, is used on palladium electrical contacts to improve reliability. The silver in the alloy improves the wearing properties of the gold, yet it does not increase the contact resistance which commonly occurs with formation of sulfides or oxides if the contacts are operated infrequently.

A need for this type of contact material led company engineers to investigate the feasibility of electroplating an 8% gold-silver alloy. Preliminary experiments of an exploratory nature showed favorable results and led to further studies, summarized in this paper, that were concerned with data needed for the construction of a pilot plant processing unit.

Certain physical properties are necessary for a contact material. The deposited gold-silver alloy must be relatively smooth and sufficiently ductile to adhere to the palladium base when subjected to shearing and welding operations in contact manufacturing processes. In obtaining preliminary information, a cylindrical stainless steel container was used as an insoluble anode, while a highly polished stainless steel rod about $\frac{1}{4}$" diameter was used as the cathode. The gold alloy plating solution had a total metal content of two oz./gal. with eight per cent as silver and a free potassium cyanide concentration of two oz./gal. The cathode extended through the solution and was supported by a two-inch watch glass at the bottom of the container. The watch glass not only insulated the cathode from the container, but also covered a portion of the container bottom and, thereby, eliminated a high current density area at the bottom end of the cathode.

Operating at 120°F., 2 amp./sq.ft. and using moderate agitation, this bath produced deposits having a composition of 45% silver. Continued deposition decreased the solution's silver to gold ratio, which caused a decrease in the silver percentage of the deposited alloy.

In an effort to establish a relationship between silver content of the solution and composition of the alloy produced, the deposit and a solution sample were analyzed for silver after each trial. For these trials, the deposits were one mil in thickness. This procedure was continued until a point was reached where the deposited alloy consisted of 8% silver.

This approach was abandoned, however, when it was found that an accurate reproducible solution analysis was very difficult. For example, in a 20 cc sample of solution which contained a 2 oz./gal. metal and 2% silver, the resultant 3 mg. of silver was insufficient for a precise analysis. A second approach to the studies involved the precise preparation of a stock solution. A new portion of solution was used for each test, thus doing away with cumbersome analytical tests of the preliminary experiments.

### *Summary of Experiments*

SOLUTION COMPOSITION OBSERVATIONS:

In tests which provided workable data, a cyanide

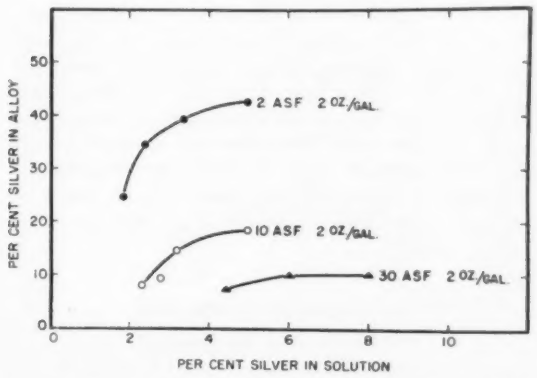



Figure 1. Effect of solution gold-silver ratio upon alloy composition. Deposits made at 180°F.

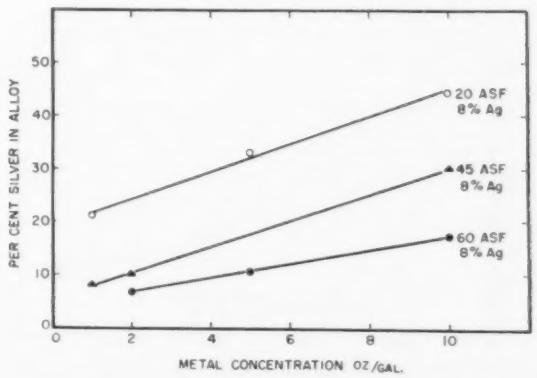



Figure 2. Effect of solution metal concentration upon alloy composition. Deposits were made at 180°F. using moderate agitation.

type bath was used with gold introduced as potassium gold cyanide. For most test deposits, a free potassium cyanide content of 3 oz./gal. was found suitable. In the range tested (1 to 10 oz./gal.), the effect of free cyanide concentration upon alloy compositions was very small.

The important variables of solution composition were found to be:

(a) Total metal ion concentration

(b) Silver-gold ratio (or per cent silver in solution)

Figures 1 and 2 show how an increase in either one of these factors will bring about an increase in alloy silver content. Another significant observation made was that increasing metal concentration increased the effect of other variables upon alloys composition.

Although solution compositions with a range of 2 to 8% silver and 1 to 10 oz./gal. were tested, an 8% silver solution was selected for investigation because limiting the silver to this ratio avoided solution composition changes when plating an 8% alloy.

CURRENT DENSITY OBSERVATIONS:

Goal of most plating operations, a high current density, was found to be most desirable because it not only reduces plating time, but also reduces the effect of other variables, such as solution composition and agitation, on alloy composition. Also, a high current density overcomes, to some extent, localized variations of alloy composition which are due to a non-uniform current pattern in a plating cell.

Figure 3 shows the relationship between current density and alloy composition for several solution compositions. It will be noted that the deposit silver content varies inversely with current density. The magnitude of variation, however, depends upon other factors, such as metal concentration, per cent silver in solution, and temperature. It is quite clear that the alloy silver content decreases as current density increases. Unfortunately, an increase in current density loses its advantages when a point is reached where rough and nodular deposits occur.

TEMPERATURE EFFECTS:

Test temperatures varied from 120°F to 180°F and

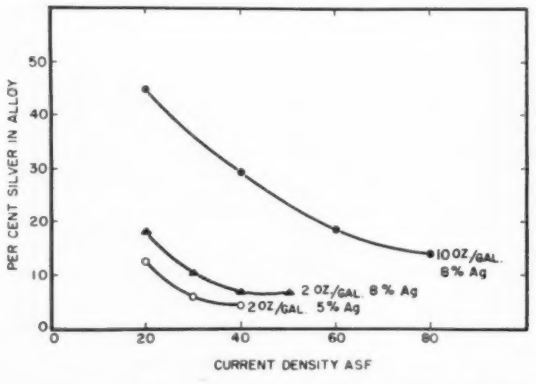



Figure 3. Effect of current density upon alloy composition. Deposits were made at 180°F. and using moderate agitation.

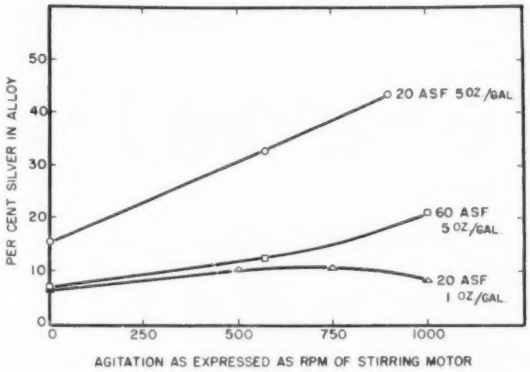



Figure 4. Effect of solution agitation upon alloy composition. Deposits were made at 180°F. and from a solution containing 8% silver.

major effects of such variations were associated with the physical properties of the alloy. Deposits were brittle at 120°F., shiny and brittle at 150°F., while at higher temperatures they became ductile. For this reason, most tests were carried out at 180°F. Since temperature did not affect composition significantly, it was controlled only to about ±5°F.

IMPORTANT EFFECTS OF AGITATION:

It was found that the degree of solution agitation affected not only the composition of the deposited alloy and its physical properties, but had critical relationships with other plating conditions. These relationships were complex and hard to optimize, making it difficult to maintain a uniform composition over the surface of a given cathode area. In addition, such complex relationships did not make it easy to obtain reproducible results. Eliminating agitation altogether, on the other hand, produced excessively rough and nodular deposits.

In an effort to analyze the effects of agitation on deposit characteristics, a procedure was undertaken which involved making four deposits representing four degrees of agitation for each set of plating conditions. The results may be seen in Figure 4. The agitation versus alloy composition relationship was made from deposits plated from solutions having 8% silver at a temperature of 180°F.

As shown in Figure 4, the effect of agitation may be minimized with this set of plating conditions: current density is 20 amp./sq.ft., 1 oz./gal. total metal content, and 8% silver. From Figure 4, it is also evident that a greater effect of agitation on alloy composition occurs at higher metal concentrations. However, reducing metal concentration to overcome this disadvantage is limited by the fact that the metal content cannot be reduced below the value needed for practical operating current density.

### *Anomalies of the Physical Properties of the Deposit*

The final test of physical properties of deposits would be determined of course, by service tests and

manufacturing operations associated with the production of apparatus using the 22 carat overlay type. For immediate experimental studies, the qualitative physical properties were noted by observing the behavior of the deposit while peeling it from the cathode. To the naked eye, thick deposits appeared smooth but, under a binocular microscope, they generally appeared quite rough. Under the experimental conditions, it was found difficult to obtain a smooth deposit one to two mils thick as required by the application, although the smoothness of deposit improved as the silver content increased.

In general, the properties of the deposit were dependent upon a critical interrelationship between all plating conditions. For example, an increase in temperature allowed a greater latitude in the conditions which gave a ductile deposit. Rough or nodular deposits occurred with high current density or a low degree of agitation. For each set of plating conditions an optimum degree of agitation existed, with a rough deposit surface resulting from either an increase or a decrease in agitation.

### *Summary*

Electrodeposition of an 8% silver-gold alloy is difficult because close control is required over nearly all plating conditions. Increases in metal concentration, agitation, and silver to gold metal ratio all tend to increase silver content, while an increase in current density tends to decrease the alloy silver content. However, experiments indicate that conditions can be selected to produce an alloy containing 8% silver and 92% gold from a solution containing the same metal ratio. Of the combinations of current density, solution composition, and agitation which will yield an 8% alloy, a set of conditions which minimizes the effects of plating variables are:

| | |
|---|---|
| Total Metal Concentration | 1 oz./gal. |
| Silver in Solution | 8% |
| Free Potassium Cyanide | 3 oz./gal. |
| Current Density | 30 amp./sq.ft. |
| Agitation | Moderate |
| Temperature | 180°F. |

An alloy deposited under these conditions had a composition of 7.8% silver.

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## FIRM ADHERENT PLATING FOR ALUMINUM

(*Continued from page 54*)

### *Results*

Over 50 samples of aluminum of varying alloy composition, specifically 24ST, 3S, and sand castings, were treated as outlined above, including the heat treatment step. After the prepared samples had been activated, copper (acid and cyanide), chromium, nickel, zinc, cadmium, gold, tin, and solder were plated on the conditioned surface. After these metals had been plated on the aluminum samples, they were subjected to the following tests to evaluate the adhesion. Some samples were heated to 600°C. for 30 minutes; some were dipped in a 500°F. oil bath for 10 minutes; some were given bend tests; and others were left untouched in the laboratory for six months. In no case did the samples show any degree of blistering, peeling, or other evidences of poor adhesion.

### *Summary*

Several methods of plating on aluminum were evaluated to establish a method which would give perfect adhesion between the plated metal and the aluminum and, to a lesser extent, a method which could be utilized by the general type of plating personnel. The familiar zincate process was evaluated but did not give the desired results unless used by skilled personnel. A modification of the zincate process was investigated and found to give more consistent results than the normal zincate method. However, this method did not fulfill the requirements desired. A method which was developed in England of putting nickel on aluminum, instead of zinc, was investigated and found to be a great improvement over the zinc coating methods. This process, too, was not acceptable because of high operating cost and because perfect adhesion was not obtained in every case.

Although the above nickel process appeared to be satisfactory, a method was developed which would be acceptable in every case. This method consisted of etching the aluminum article in a hydrofluoric acid solution, in a hydrochloric acid and manganous sulfate solution, nickel plating, heat treating, and then subsequent plating a desired metal. It was found that this process, in every case, produced firm adherent coatings on varying alloys of aluminum.

### *Bibliography*

1. J. M. Bryan, J. Electrodep. Tech. Soc., **26**, 181 (1950).
2. J. H. Perry, Chemical Engineers Handbook, McGraw Hill, New York, 3rd Ed., p. 1798 (1950).
3. C. J. Smithells, *Metal Reference Book*, Interscience Publishers, Inc., New York, p. 282 (1949).

# An Introduction to Wash Primers

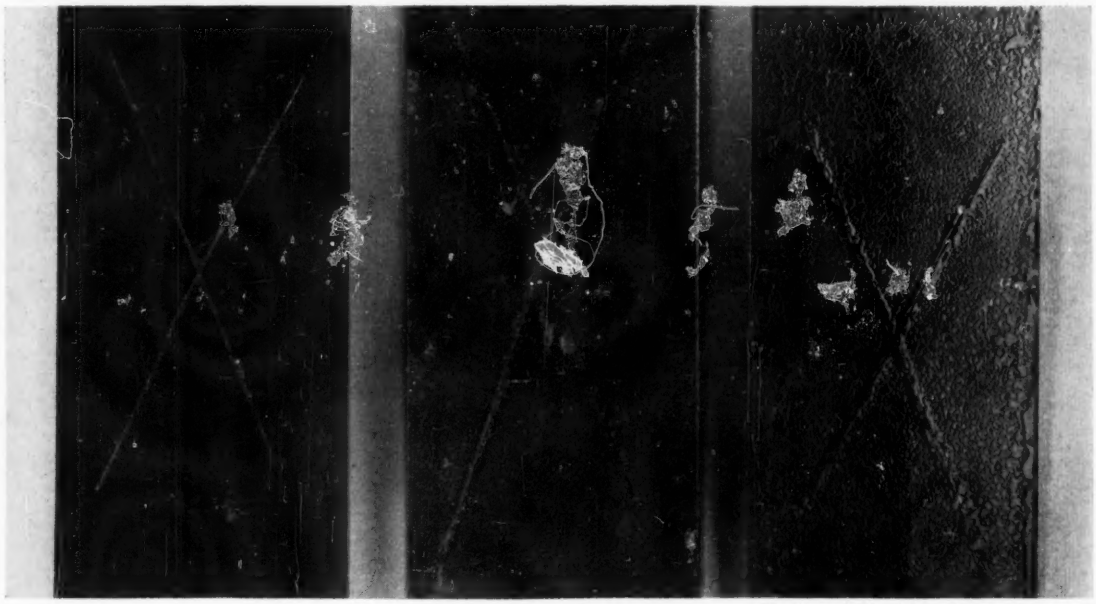
By E. S. Beck

**The following article is the first of a two part series dealing with wash primers. Because knowledge of such primers — their formulations and applications — has increased in recent years, the reader may find a number of interesting and profitable applications for them. A second and concluding article will appear in next month's METAL FINISHING.**

LIKE so many of the newer technical developments, the wash primer originated during the Second World War. It was perfected in the laboratories of one of the larger manufacturers of plastic materials, and first attained wide usage as the initial coat on steel hulls of ships. For years, its principal use remained as the first coat on steel hulls. Gradually, its use spread, and as more and more metal finishers discovered its value, the applications of wash primer increased many fold: until today it is used on such a wide variety of items, that listing them would almost constitute a catalogue of American heavy industry.

The term "wash" when used in this connection has little to do with ablutions in the bath tub or shower. Rather it is derived from the artist's use of the word. In water-color work a wash is a brushing over (or smearing) of the surface with a thin coat of dilute color. The wash coat is very transparent, and weak in color. The application to the wash primer used in coating metal is very apt. Here, too, a very thin, transparent "wash" coat is applied. Here, too, the color is very weak, and the covering very low.

When wash primer is applied (generally by spray, although it lends itself to application in other ways as well) the application is considered just right when a greenish-yellow tint is imparted to the metal. There is no attempt to obtain coverage, hiding, build or filling of the metal. Just a thin, uniform coloration of the metal. About 0.3 mil is generally considered optimum. Much more will tend to prove deleterious; much less will make a discontinuous film. This sounds like a critical condition. Actually, any applicator with a little experience can readily learn how to apply the proper thickness with a little practice. The solids of the material are quite low, so that getting a small film thickness dry with a smooth wet application presents no difficulties. The same low solids make it difficult to apply an excessive film thickness inad-



*Courtesy of Shawinigan Resins Corporation*

A B C

Figure 1. HUMIDITY TEST RESULTS.

These panels are cleaned steel without phosphate treatment. Panel A was topcoated with alkyd enamel over wash primer. Panel B and C were unprimed and coated with two different alkyd enamel topcoats. The panels were exposed to 500 hours continuous humidity (100 degrees F. and 100% R.H.). The differences between the panels with the wash primer and those without are quite striking. Panel B is covered with small blisters and also shows rust creepage at the scores. Panel C shows blistering at the scores and very heavy alligatoring all over the panel. Panel A, the one with wash primer, is practically intact.

vertently. Finally, too low a film thickness can be avoided by learning to judge the depth of color applied.

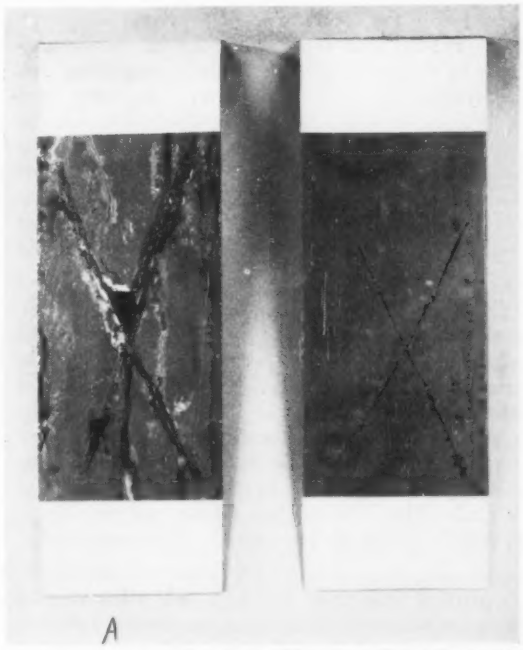
It is difficult to believe that such a thin film can contribute anything substantial by way of performance. Yet, as will be shown, the improvement in corrosion resistance, adhesion, or durability is in some cases nothing short of startling. A great many research groups have studied this problem, from a number of starting-points. Several government departments as well as a number of chemistry departments of universities have explored it also. The answers have been slow in coming. The value of the wash primer has become ever more well-documented; but our understanding of how it works is still a matter of conflicting hypotheses.

The writer, who has a healthy respect for the virtues of wash primer, based on practical performance, views its properties as chiefly deriving from the greatly improved adhesion it confers to the paint system. Many coatings of impeccable chemical inertness lack adhesion to all or some surfaces. Put such a coating over wash primer and in most cases, a tight bond of excellent adhesion is obtained. Vinyl-alkyds are a case in point. There is no doubt that vinyl-alkyds can be formulated to adhere to metal, but the adhesion at best is not outstanding. And to obtain adhesion, it is necessary to increase the alkyd content, thereby lowering the resistance. Vinyl-alkyds which are high in vinyl content show maximum chemical resistance, but can be peeled off steel surfaces like a strippable coating. When a coating of this type is applied over wash primer, it adheres, and strongly.

This is just one example, of course, and it is not to be assumed that all known finishes will adhere to wash primers. In fact, to stay near the example given, only a limited number of vinyl resins will adhere to a wash primer (essentially the hydroxyl-bearing copolymer, as Vinylite VAGH). Plastisols and organosols will not adhere, unless modified with a sufficient amount of the adhering type. A few types of nitrocellulose lacquers also will not adhere. But practically every other type of coating will.

There are actually a number of different wash primers in use today. The one which was developed first, and commonly known as WP-1, is still by far in greatest use, and is the one we will consider first. The material is supplied in two packages, the first containing the wash primer base and the second the catalytic reducer. The reducer, being strongly acid, must be kept in glass, polyethylene, or some other inert material.

The catalytic reducer must be blended with the wash primer base before use; and the mixture thus prepared has a relatively short life, once it is mixed. There are various time limits fixed for the wash primer, but the safest is to consider its useful life to be no more than 8 hours once the two components are mixed. No change takes place in the appearance of the mixed material as it is aged, but the mixed material loses its adhesion properties, so that its adhesion is down very badly by the end of 24 hours.




*Courtesy of Shawinigan Resins Corporation*

**Figure 2. SALT-SPRAY TEST RESULTS**

**Two test panels of cleaned plain steel. Panel A is without wash primer and Panel B is coated with wash primer. Both panels are topcoated with the same alkyd enamel. The panels were exposed to 1000 continuous hours in the salt-fog cabinet (5% salt at 100 degrees F.). Panel A, without wash primer shows severe corrosion over most of the surface, and is especially bad at the scores. Panel B (with wash primer) is practically unaffected; and shows almost no sign of rust-creepage at the score.**

Ultimately, the mixture will gel, but it loses its usefulness long before this.

As was pointed out above, wash primer was originally developed for use on ships during the last War. Previously, ships had been sand-blasted or wire-brushed and treated with a phosphoric acid solution before painting. The phosphoric acid solution could not be applied in cold weather because of its tendency to freeze. A further drawback was the uneven adhesion shown by subsequent coats of paint. These were influenced by the variations in quantity of phosphoric acid on the surface; the variations being inevitable because of the method of application.

A further drawback was the susceptibility of the treatment to failure unless the atmospheric conditions were ideal between the time the acid treatment was applied and the time the coating was put on. If the humidity were high on the day the preparation was done, the paint job could turn out weak or even a total failure. If it rained on the phosphated surface, all was lost. Generally a new wet-sandblasting was also needed.

It can be seen from this that some improvements in the system would be welcome. It must also be remembered that in addition to the defects outlined above, the finishing system was limited by the fact that the phosphate treatment had no weathering qualities, and had to be coated with paint immediately.

When research was begun (under the Bureau of

Ships, but in the laboratories of a private company) it was natural that work would center around materials as similar as possible to those actually in use. The system did work well, when everything went right. Thus, it was natural that alcohols should be considered as the replacement for water with the phosphoric acid. Alcohols are the organic materials closest in composition and properties to water. Phosphoric acid is soluble in them, at least in the simpler members of the group, such as methyl, ethyl and isopropyl alcohols.

The value of chromate ion as a rust-inhibiting material was wellknown, and before long, work on the inclusion of this substance was also under way. Zinc chromate was the most effective and popular means of introducing chromate ion in the paint world of the day. It still is today, incidentally. Ordinary zinc chromate was too soluble for the purpose, so the recently-popularized basic zinc chromate was adopted for study. This is much less soluble, yet provides a dependable source of chromate ions in aqueous media.

Naturally, the question of a binder or vehicle for this pigment next arose. There are only a few vehicles which are soluble in alcohol. Among these are shellac, a special grade of nitrocellulose, a few maleic resins, polyvinyl butyral and polyvinyl formal, and one or two other materials. Polyvinyl butyral stood out at once as a real possibility. Its quick dry, relative inertness, and above all, its well-known outstanding adhesion made it seem most promising.

This brief presentation makes the present composition of wash primer seem almost inevitable. Perhaps it is, but the composition finally arrived at was the result of long and patient laboratory work. Not only were the materials themselves subject to selection and change, but the ratios between the components had also to be established.

An aspect of the problem which is of great interest, is that in the case of wash primer, the whole is greater than the sum of its parts. It was soon found that over-all properties were obtained in some cases which were far beyond expectations. And if an ingredient were omitted, there was frequently not merely a diminution in properties, but an almost complete loss of good properties. Perhaps it will now be useful to examine the constituents of wash primer to see what each contributes individually; and also to see how each material interacts with the other.

The WP-1 formula contains four principal components:

(1) Polyvinyl Butyral Resin
(2) Basic Zinc Chromate Pigment
(3) Phosphoric Acid
(4) An oxidizable alcohol solvent, such as Isopropyl Alcohol or Normal Butyl Alcohol.

Much careful work has established that all four of these components must be present in order for satisfactory results to be obtained. If any one of them is omitted, the results obtained with the wash primer will be poor. It is established tentatively that all four are somehow involved in an interaction not too well understood. We can review what has been published on the subject by considering each component individually, and looking at its part in the group reaction at the same time.

The polyvinyl butyral resin essentially serves as the binder in the wet state. It helps to keep the pigment in suspension, and to give some viscosity to the material. It serves to seal the metallic-phosphate coating which forms on the metal surface. It also is the principal factor in providing the adhesion to succeeding coats of paint. Rosenbloom[1] demonstrates that the polyvinyl butyral resin is essential to the reaction. The resin apparently increases the solubility of the basic zinc chromate pigment to the point that it can participate in the oxidation-reduction reaction taking place as an essential part of the process. In the absence of the resin, the reaction does not take place. The phosphoric acid also reacts to some degree with the resin, but again only in the presence of the pigment and an oxidizable alcohol. This emphasizes the interrelated activity of the four materials once again.

The basic zinc chromate pigment serves first as a source of zinc for the production of zinc phosphate. The zinc phosphate is deposited on the metal surface in a manner similar to that obtained with commercial zinc phosphate conditioning metal treatments. It also serves as a source of chromate ion which help close any pores in the zinc phosphate coating. (An analogous chromate final rinse is very frequently used for this purpose in commercial phosphatizing systems). The mechanism is considered to consist in the oxidation of any exposed iron surface to a less reactive form. The chromate also participates in the more obscure and complex oxidation-reduction reactions known to be occurring in the mixture.

The phosphoric acid is perhaps the most important single factor in the development of adhesion. Rosenbloom[1] considers the adhesion to be governed by the degree of acidity of the mixture. It can be shown that the adhesion as measured by the Bell Scratch Adhesion Tester increases as the percentage of the phosphoric acid is increased. This adhesion function is discussed by Kruger and Blum[2] who postulate the formation of an iron-zinc-phosphate complex at the surface of the metal. The layer closest to the metal surface is probably richest in iron, and the quantity of zinc increases as we go out from the metal surface. The resinous component of the wash primer is probably bonded to the phosphate complex by means of a chromium-resin association compound.

This sounds very complicated, and indeed it is. The explanations offered are educated guesses, supported in part by scientific data, but are far from being soundly established. Much more work needs to be done to establish a firm underpinning of theory for this process. But a great deal of work is known to be underway, and there is no doubt that our understanding of the processes taking place in the film will increase markedly as more results of research are published.

# Science for Electroplaters

## 32. Cyanide Waste Treatment--Hypochlorites

By L. Serota

A METHOD which is most widely used for treating cyanide waste is based upon the oxidizing action of the hypochlorite ion. The hypochlorite ion may be made available as a reagent from such materials as the following: the solution of liquid chlorine in water; a sodium hypochlorite ($NaOCl$) solution, prepared by absorbing chlorine gas in a caustic soda solution or purchased as a commercially prepared hypochlorite solution; solid calcium hypochlorite or chloride of lime (bleaching powder, $CaOCl_2$). The solid oxidants can be added directly as a slurry (water paste) or changed to the sodium salt.

*D. Milne* notes that substitution of sodium hypochlorite solution for chlorine gas in this oxidation process eliminates such difficulties as heat of solution developed and low solubility of chlorine gas. This advantage permits a more rapid addition of the reagent, the rate being limited by equipment capacity only. Another advantage in the use of hypochlorite solution is the saving of the cost connected with handling chlorine gas cylinders. Storage of sodium hypochlorite solutions, however, requires corrosion resistant material. Another factor to consider in the use of hypochlorite solution in batch treatment is the increase in volume resulting from the addition of this solution. The use of solid chloride of lime (35 per cent available chlorine) may cause a large sludge volume. The calcium hypochlorite of 70 per cent available chlorine, which is generally preferred, will give much less sludge volume. The suggestion has been made by *B. F. Dodge* and *W. Zabban* that (commercial) calcium hypochlorite when used as a solid, because of the increased sludge formation compared to chlorine or sodium hypochlorite, be limited to treatment of cyanide solutions containing less than 5000 ppm. CN.

### *Oxidation Stage*

Oxidation of cyanides by hypochlorites proceeds, as with chlorine gas, in two stages: with conversion of cyanide to cyanate first, followed by complete decomposition yielding carbon dioxide and nitrogen as the end products. Dodge and Zabban have also reported that there is disagreement in the literature pertaining to the quantities of reagents required for oxidation of cyanide to cyanate or for complete decomposition, and that little experimental data are available on the use of hypochlorites. In addition, information is limited on the effect of pH, other than that a value higher than 8.5 is required to prevent the formation of cyanogen chloride which is toxic, or possibly nitrogen trichloride, an explosive as well as irritating compound affecting the eyes and nasal passages. The formation of cyanogen chloride occurs with hypochlorites according to the following ionic equation: $CN^- + HOCl \rightarrow CNCl + OH^-$. (**1**)

Hydrolysis of cyanogen chloride, yielding cyanate, though very slow in neutral solutions, will occur readily in alkaline solutions according to *C. A. Price* and associates: $CNCl + OH^- \rightarrow Cl^- + HOCN$. (**2**) This reaction, it was observed, proceeded at a slow rate at pH 8, at a more rapid rate at pH 10 and was accelerated by a buffered (pH 7.09) monobasic phosphate-sodium hydroxide solution. The reaction, because it is so rapid and complete, the authors note, may be utilized analytically by titrating the liberated chloride ion. Although cyanogen chloride hydrolyzes slowly in water, it was found to react readily with hypochlorite (stoichiometrically) at pH of 7 to 8, which compares with the oxidation of the nitrogen, in the compound, to the gas: $NaCN + HOCl \rightarrow ClCN + NaOH$. (**3**)

The rate of disappearance of cyanogen chloride in the reaction, $2ClCN + 3HOCl + H_2O \rightarrow 5HCl + 2CO_2 + N_2$, (**4**), according to measurements, indicates that it was complete in about five minutes.

Oxidation of cyanides to cyanates by hypochlorites proceeds rapidly, but further oxidation to carbon dioxide and nitrogen is slower, ranging in time from one half hour to a day. In an alkaline solution, the reaction may be represented as follows: $2CNO^- + 3OCl^- + H_2O \rightarrow 2CO_2 + N_2 + 3Cl^- + 2OH^-$. (**5**) Metals in such plating solutions will not affect this reaction and will be precipitated, according to Dodge and Zabban, as carbonates,

| | Solution Treated | | |
|---|---|---|---|
| | Sodium Zinc Cyanide | Sodium Cadmium Cyanide | Sodium Cupro-Cyanide |
| Concentration of cyanide, ppm CN | | | |
| Untreated solution | 83.8 | 85.6 | 74.2 |
| Treated solution | 0.1 | 0.1 | 0.1 |
| Toxic metal in treated solution after neutralization, ppm | 2 (Zn) | 0.03 (Cd) | 0.05 (Cu) |
| Caustic soda added, lb NaOH/lb CN | 2.28 | 2.38 | 4.77 |
| Bleaching powder added, lb available $Cl_2$/lb CN | 3.03 | 3.03 | 3.30 |
| Sodium thiosulfate used, lb $Na_2S_2O_3.5H_2O$/lb CN | 0.2 | 0.2 | 0.3 |
| Bleaching powder used, lb available $Cl_2$/lb CN | 3.00 | 3.00 | 3.26 |

Table I. Results of chlorination treatment of 250-gallon quantities of dilute synthetic solutions of complex metallic cyanides.

oxides, and hydroxides. Rapid addition of hypochlorite (or chlorine gas) could be the cause of cyanide sludge formation in the treatment of copper or zinc cyanide solutions. This effect can be reduced by rapid agitation.

Chlorination treatment of complex metal cyanide solutions by the use of (calcium) hypochlorite, as a method of disposing of plating shop effluents, has been reported by *A. E. J. Pellet.* In this process 250 gallon batches consisting of zinc, cadmium, and copper (cuprous) cyanide solutions were treated. The solutions were made alkaline (pH 11) with milk of lime or caustic soda. Oxidation was effected by the slow addition of a bleaching paste with constant stirring. The starch-iodide test, which gave a blue color when an excess of available chlorine was present, served as an indictator. Residual chlorine was removed after oxidation by adding, while stirring, sodium thiosulfate. Results obtained with these prepared batches indicated that simple cyanides as well as the complex cyanides of zinc, cadmium and copper were decomposed. Results are shown in Table I. Chlorine and cyanogen chloride were reported absent in the treated liquor and few traces remained of the toxic metals, while the solution became virtually harmless (non-toxic) to fish. The lachrymous vapors of cyanogen chloride were detected during chlorination, which led to the suggestion that a covered tank would be advisable in plant scale operation. Solutions containing nickelocyanide react at a slow rate to this chlorine treatment. This method is therefore not considered satisfactory for treatment of such solutions.

### *Available Chlorine*

The term *available chlorine* refers to the equivalent amount of chlorine in the hypochlorite (OCl) radical represented by the following equations:

$$Cl_2 + 2NaOH \rightarrow NaOCl + NaCl + 2H_2O \quad (6)$$

$$2Cl_2 + 2Ca(OH)_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O \quad (7)$$

In equation (6) one mole (molecular weight) of chlorine yields (is equivalent to) one mole of sodium hypochlorite (NaOCl), while two moles (twice the molecular weight) of chlorine in equation (7) yield only one mole of calcium hypochlorite $Ca(OCl)_2$.

| Run No. | Total CN ppm | Available $Cl_2$ lb per lb CN | Initial *pH* Value | Final *pH* Value | Amount CNCl Evolved mg/gal | Amount HCN Evolved mg/gal | Temp. Rise °C |
|---|---|---|---|---|---|---|---|
| 200 | 98 | 5.46 | 10.5 | 10.4 | 0.74 | 0 | 0.5 |
| 201 | 98 | 2.73 | 10.5 | 10.2 | 1.21 | 0 | 0.5 |
| 202 | 9800 | 2.73 | 12.1 | 11.3 | 5.10 | 0 | 17 |
| 203 | 9800 | 2.73 | 8.3[1] | 8.3 | 258 | 44.5 | 21 |

[1]Initial pH lowered from 12.1 to 8.3 by addition of $H_3BO_3$

Table II. Evolution of cyanogen chloride from sodium cyanide solutions treated with sodium hypochlorite.

Bleaching powder treatment of cyanide solutions was investigated on a laboratory scale. Solutions of sodium cuprocyanide and sodium zinc cyanide, containing cyanide concentrations ranging from 10.6 to 55,700 ppm., required 3.64 parts of available chlorine (38.2 per cent chlorine bleaching powder) for one part of cyanide, to oxidize the cyanide to cyanate in dilute solutions (20 ppm.); and twice the amount of chlorine in solutions containing 100,000 ppm. NaCN. In the copper solution the bleaching powder had the effect of preciptating black copper (cupric) oxide, CuO, from a weak solution and the blue basic copper carbonate, $2CuCO_3 \cdot Cu(OH)_2$ or $CuCO_3 \cdot Cu(OH)_2$, from concentrated solutions, with 2 to 6 ppm. of copper remaining in solution. Preciptation of zinc as basic zinc carbonate ($ZnCO_3$) from the cyanide solution, after oxidation, was effected by adding sodium bicarbonate. If, after oxidation, the zinc cyanide is diluted, zinc hydroxide, $Zn(OH)_2$ will precipitate. Hydrolysis will result in formation of the zincate ion ($ZnO_2$). The amount of zinc remaining in solution is 5 ppm. Additional information relating to chlorination indicates that the pH of the cyanide solutions during the treatment with bleaching powder should be 11.5 or higher to avoid the formation of cyanogen chloride or nitrogen trichloride.

### *Oxidation Factors*

In an effort to clarify some of the conditions affecting oxidation of cyanides by hypochlorites, the research program of A.E.S. Project #10 undertook an extensive study on a laboratory scale, in which the following factors were investigated: oxidation of cyanides to cyanates, hydrolysis of cyanogen chloride, removal of toxic metallic ions, decomposition of cyanides, acid hydrolysis. The variables considered were ratio of reagent to reactant, pH, and time.

In the oxidation of cyanide to cyanate by hypochlorites, with the exception of solutions containing the nickel (ous) ion, the rate was very rapid. For example with sodium hypochlorite, cyanide solutions of sodium and copper, ranging in concentration from 98 ppm., CN and 63.5 ppm. Cu (pH 10.8) to 25,500 ppm. CN and 16,500 ppm. Cu (pH>11), and cyanide solutions of sodium and zinc, with such variations as 100 ppm. CN and 63.5 ppm. Zn (pH 11.5) to 48,300 ppm. CN and 33,400 ppm. Zn (pH 11), the time of reaction for consumption of the required amount of available chlorine was less than 3 minutes, with little change in pH. Comparable results, in time, were obtained with calcium hypochlorite. Solutions of sodium and nickelocyanide required about one half hour for completion of the same reaction. While no explanation is offered for this difference, the report notes that the hypochlorite ion oxidized the nickelous ion in a nickel chloride solution quite rapidly, but a time lag occurred in solutions containing 1000-5000 ppm. of CN. This delay was associated with a black preciptate (nickel oxide) which occurred several minutes after the addition of the hypochlorite. Decomposition of the zinc or copper complex ion occurred much more rapidly.

The available chlorine required to oxidize the cyanide ion to cyanate was 2.73 pound per pound of cyanide in the case of zinc but was higher for the copper and nickel solutions, a con-

dition attributed to the oxidation of these metal ions to the higher valence stage. The calculation for the ratio of 2.73 pounds available chlorine per pound of cyanide to oxidize cyanide to cyanate is as follows: one pound of cyanide (CN) = 1/26 = 0.03846 mole CN. From equations (1) and (2), one mole CN is equivalent to 1 mole HOCl, which is equivalent to one mole chlorine. Therefore 0.03846 × 71 = 2.73 pounds chlorine. The average of 3.15 pounds of available chlorine per pound of cyanide (about 15 per cent excess) for copper plating solutions will vary with the concentration and type of copper solution. Oxidation of the cuprous to the cupric ion stage was found, experimentally, to follow the stoichiometric values, with two moles of cuprous ion being oxidized by one mole of hypochlorite ion. Oxidation of the nickelous ion to nickelic by hypochlorite in any type of solution, experiments showed, required 3.5 to 3.7 times the theoretical amount (2.12-2.24 pounds of available chlorine per pound of nickelous ion).

A five per cent excess of chlorine (based on cyanide and nickel), it was found, would not remove cyanide completely in a short time. A twenty per cent excess was required to reduce the cyanide concentration to 0.8 ppm. in about forty minutes. The recommended pH value for this treatment is 10-12.5. Above a pH value of 10, the hypochlorite ion will first oxidize the cyanide to cyanate before decomposition (oxidation) of the cyanate ion occurs. When chlorine is used, the pH will decrease as a result of the formation of hydrochloric acid unless sodium hydroxide is added in stoichiometric amounts (3.08 pounds NaOH per pound CN) for neutralization. One mole CN is equivalent to two moles NaOH (equations (1) and (2)), hence 0.03846 (mole CN) × 80 = 3.08 pounds NaOH per pound CN.

When calcium hypochlorite is used, it will cause a decrease in pH because the commercial grade (HTH) contains only about 2.7 per cent calcium hydoxide, which is not sufficient to neutralize the acid due to the hydrolyzed calcium chloride. Here, too, sodium hydroxide must be added to maintain a pH value above 10. The incomplete removal of cyanide by calcium hypochlorite, even when used in excess of the amount required to oxidize cyanide to cyanate, was found to be due to local reactions (because the solid calcium hypochlorite did not dissolve rapidly) which provided an acid pH condition, thereby resulting in some local oxidation (decomposition) of cyanate before all the cyanide was converted to cyanate.

Since oxidation of cyanides by hypochlorites is an exothermic reaction, the temperature increase of an alkali-metal cyanide solution will depend upon the cyanide concentration. High concentrations will result in a considerable increase in temperature, such as a 56°C. rise recorded for several runs of a sodium-zinc cyanide solution containing 48,300 ppm. CN. The temperature rise for solutions containing less than 5000 ppm. CN was found, generally, to be less than 20°C. and an increase of less than 5°C. will result if the concentration is less than 1000 ppm. CN.

Treatment of cyanide solutions with calcium hypochlorite will result in a greater quantity of sludge formation, due to the presence of some calcium hydroxide, than that obtained with chlorine or sodium hypochloride. Results showed that a sodium-zinc cyanide solution with a concentration of 4,560 ppm. CN gave a four per cent volume of settled sludge when sodium hypochlorite served as the reagent, and an eleven per cent volume of settled sludge when calcium hypochlorite was used. The precipitate was zinc hydroxide, $Zn(OH)_2$. With sodium copper cyanide solutions containing 9800 ppm. CN, the settled sludge volume was seven per cent with sodium hypochlorite as the reagent and twenty-six per cent when calcium hypochlorite was used. The difference in sludge formation is pronounced for cyanide solutions containing more than 2000 ppm. CN. The precipitate was reported as copper oxide, CuO, or copper carbonate, $CuCO_3$. Reduction of sludge formation caused by calcium hydroxide may be accomplished by using a solution of previously dissolved calcium hypochlorite instead of the solid form.

### *Hydrolysis of Cyanogen Chloride*

The formation and rate of hydrolysis of cyanogen chloride resulting from the oxidation of cyanide to cyanate in cyanide solution when a hypochlorite is added as the oxidant, in required amounts (or in excess), was found, experimentally, to depend upon the pH of the solution. Above a pH of 9, using about a one per cent excess of hypochlorite, hydrolysis of cyanogen chloride will take place in less than five

| *Curve No.* | *Initial KCNO ppm* | *Molar Ratio NaOCl/KCNO* | *pH* |
|---|---|---|---|
| 1 | 10,000 | 1.3 | 12.5-9.4 |
| 2 | 10,000 | 1.0 | 12.3-9.4 |
| 3 | 10,000 | 0.5 | 12.4-9.4 |
| 4 | 50,000 | 1.0 | 12.5-9.4 |
| 5 | 50,000 | 0.5 | 12.1-9.4 |
| 6 | 1,000 | 1.0 | 11.0-9.4 |

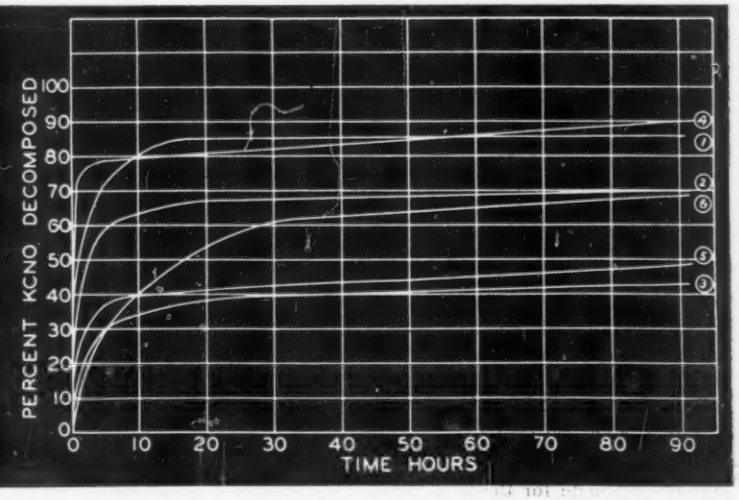



Fig. 148. Oxidation of potassium cyanide in aqueous solutions by sodium hypochlorite at room temperature.

minutes. The rate of hydrolysis becomes less as the pH is lowered, but may be increased to a rate of less than five minutes when the pH is below 9 if a large excess of hypochlorite is used. In one experimental run, when a large excess of hypochlorite was used, with a boric acid-sodium hydroxide buffer at a pH value of 8, hydrolysis of cyanogen chloride occurred in five minutes.

That evolution of cyanogen chloride occurs when sodium cyanide solutions are treated with hypochlorite at a pH value of 10.5 or higher, is shown in Table II. The authors stress the fact, as revealed by the date, that hydrolysis of cyanogen chloride proceeds at a faster rate at a higher (alkaline) pH.

### *Metal Ion Removal*

The toxicity of the metal ions, even in small quantities, in wastes, and their effect on sewage digestion processes, have been the basis for increasing stringent emphasis upon maintaining a minimum allowable concentration (as low as 0.1 to 0.2 ppm. for copper and zinc) before emptying such wastes into neighboring streams. With regard to the metal concentration remaining in a cyanide solution after hypochlorite treatment, results reported show that a sodium copper cyanide solution (98 ppm. CN, 63.5 ppm. Cu), when treated with calcium hypochlorite (3.08 pounds available chlorine per pound of cyanide (CN), will have 1.4 ppm. copper remaining in the solution when the pH is 11.5. A sodium-zinc cyanide solution (91.2 ppm. CN, 58 ppm. Zn), when treated in the same manner with 2.88 pounds available chlorine per pound of cyanide at a ph of 11.1, will show more than 40 ppm. of zinc remaining, which is reduced to 4-5 ppm. Zn when the pH is lowered to about 9. The high remaining metal concentration (40 ppm.) is due to the formation of the soluble zincate ion in alkaline solutions. This reaction may be reversed to form the insoluble zinc hydroxide, $Zn(OH)_2$, by dilution, thereby bringing the pH down to 9; or the pH may be lowered by the addition of sodium bicarbonate or sodium carbonate which will also result in the formation of the insoluble zinc carbonate. The data given were based upon the use of sodium carbonate for the preciptation of zinc as the carbonate.

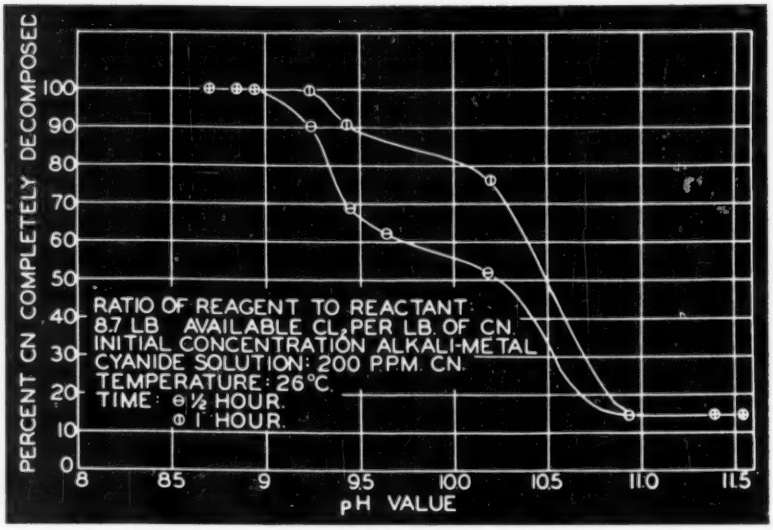



Fig. 149. Effect of pH on rate of oxidation of cyanides in aqueous solutions to carbon dioxide and nitrogen. The pH value was regulated by a $H_3BO_3$-NaOH buffer.

### *Cyanate Decomposition*

Decomposition of alkali-metal cyanates by oxidation with hypochlorite can be determined by measuring the gases liberated; or, as in A. E. S. Research Project #10, by using Nessler tubes for a comparison of intensity of color, with known standards, with variations in concentration resulting from the addition of suitable reagent. These determinations provided the necessary information for the following conclusions: oxidation, which is rapid at the start, is reduced appreciably after two hours; solutions of higher concentration (50,000 ppm. KCNO) were decomposed at a higher initial rate than lower cyanate concentrations (1000 KCNO). The reason given for this greater rate is the increased temperature resulting in an accelerated rate of hydrolysis. Complete oxidation of one mole of cyanate requires more than one mole of hypochlorite (available chlorine). The data and graph for six runs representing oxidation of solutions of potassium cyanate by sodium hypochlorite are shown in Fig. 148.

Complete oxidation of cyanides or cyanates with hypochlorite, experimental results indicate, may be attained in about one hour at a pH of 8.5. Above a pH of 11, the rate of oxidation of a cyanate is low. The overall relationship of pH to decomposition of cyanides (by oxidation), to form carbon dioxide and nitrogen, is effectively shown in the graph, Fig. 149. It will be noted that the oxidation rate shows a very rapid increase when the pH value drops from 10.5 to 9. The sodium hydroxide-boric acid buffer was used for this series of determinations. It was also observed that the use of a greater excess of hypochlorite increased the rate of oxidation of the cyanide ion at room temperature. For example, at a pH of 8.5 to 8.7 an average five per cent excess of hypochlorite resulted in about 92.5 per cent total decomposition of cyanide (to carbon dioxide and nitrogen) in one hour, whereas a 27.5 per cent resulted in 99.5 per cent decomposition. When the pH of the solution containing 2960 ppm. CN is lowered from an initial value of 11.9 to 5.9 (acid), it was found that oxidation of cyanide to cyanate with calcium hypochlorite (7.8 lb. available chlorine per pound of cyanide) occurred in three minutes with less than 0.2 ppm. CN remaining; and, in another run, when the pH value was reduced from 9.2 to 6.95 in a solution containing 10,000 ppm. KCNO, 99.5 per cent of the cyanate was decomposed by calcium hypochlorite (1.3 mole available chlorine per mole KCNO) in 1¼ hours. The ionic equation for oxidation of cyanates by hypochlorites in acid solutions is as follows:

$$2CNO^- + 3H^+ + 3ClO^- \rightarrow N_2 + 2CO_2 + 3Cl^- + H_2O \quad (8).$$

Nitrogen trichloride $NCl_3$, the authors

(*Continued on page 67*)

# SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

### Anti-Tarnish Coating on Silver

*Question*: I have been told about an anti-tarnish bath that could be used on silver. The basis of the bath was beryllium sulphate. If you have a copy of this article available I would appreciate your sending it to me. If there is no copy available, could you tell me which issue this appeared in so that I could look it up.

F. W. B.

*Answer*: The use of films of beryllium oxide to prevent tarnish was proposed by Thomas & Price in 1939, but we know of no commercial application. For details you can consult the following references, photostats of which may be obtained from the New York Public Library for a small charge:

G. J. Thomas & L. H. Price, Metal Industry (London), *54*, #6, Feb. 10, 1939.

D. T. Ewing & G. W. Jernstedt, Trans. American Electroplaters' Soc., pp. 105-11, 1940.

The process consists of cathodic treatment in a weak solution of beryllium sulfate and boric acid.

### Maintaining Chromic Anodizing Bath

*Question*: In anodizing aluminum, according to the specifications which we follow, it is imperative that we analyze and have a control on the following constituents of our chromic acid bath:

1. Chromic acid
2. Aluminum oxide
3. Sulfate as $SO_4$
4. Trivalent chromium as $Cr^{+++}$
5. Chloride as $Cl^-$
6. Iron

Inasmuch as our chromic acid bath is maintained at a concentration of 4-5%, we would appreciate information concerning the maximum allowable impurities that such a bath can tolerate before the work is not satisfactorily anodized.

E. N.

*Answer*: It is customary to start a new chromic acid anodizing bath at 5% and, as the pH rises during operation, to add chromic acid until a 10% concentration is reached. Aluminum, trivalent chromium, and iron sequester chromic acid, causing the rise in pH, so that their limits are determined by this factor. When the pH rises above 0.85 electrometric, sufficient solution is dumped and replaced with fresh chromic acid to maintain this pH, thus, automatically limiting the amounts of these contaminants in the bath. These metals may also be removed by ion-exchange.

Trivalent chromium may cause a darker oxide film but would have no other effect than the above mentioned one.

A maximum of 0.2 g./l. of chloride, as sodium chloride, is usually suggested. Larger concentrations result in etching, and this effect may be employed to determine a maximum value for your purposes.

Sulfate, in recent years, has not been considered a contaminant. Government specification MIL-A-8625, as a matter of fact, permits addition of up to 80 g./l. sulfuric acid to maintain the current density. This can be employed instead of dumping and replacement when the chromic acid content reaches 10% and the pH rises above 0.85, as suggested above.

### Plating Powder Metal Parts

*Question*: We are very anxious to find out everything possible in regard to impregnating or the sealing of porosity on parts made of sintered iron or bronze prior to cadmium or zinc plating. Will you please forward, as soon as possible, any information you may have on this subject or a list of possible suppliers of materials for this purpose.

W. L. B.

*Answer*: A large number of articles have been published on the subject of plating powder metal compacts. A survey of the field was published in the November 1955 issue of METAL FINISHING by J. B. Mohler. Unfortunately, we do not have any more tear sheets available, but if you have saved your old copies you can refer to it on page 70.

Another excellent article on plating bronze powder parts by Raymond, Foley and Chu appeared in the February 1955 issue of Plating, pp. 150-1. Photostats of these articles can be purchased at a nominal charge from the New York Public Library.

### Plating on Beryllium

*Question*: I am seeking some information on the hard chrome plating of polished and buffed brillium metal. In fact, this brillium metal is used in the manufacturing of plastic dies. One of my customers would like to know the correct procedure for hard chrome plating.

R. C. B.

*Answer*: We can find no reference to "brillium" metal. However, if your customer refers to beryllium, Beach and Faust have suggested the following procedure (U. S. Pat. #2,729,601. Jan. 3, 1956) for direct plating on this metal:

Make anode in mixture of 10% phosphoric acid and 2% hydrochloric acid for 2 minutes at room temperature and 50-150 amp./sq.ft. Then, without rinsing, dip for 2 minutes in concentrated nitric acid at room temperature. Rinse and plate.

### Acid Copper Electroforming

*Question:* As subscribers to your magazine we appeal to you for help in the following difficulty. We are electroformers, using a 10 oz. acid and 33 oz. copper sulfate solution with a 500 ampere rectifier and air agitation. We have been plating upon copper molds for the last eight years and during the past two months, without any changes in process or materials, if there is more than one mold in the bath, one will deplate and the others will not. Sometimes the mold which was deplating will begin to plate and another will begin to deplate. The effect is irregular and the molds do not touch the sides of the rubber tank or the anodes. We would appreciate hearing from you as we cannot seem to locate the trouble ourselves.

A. G.

*Answer:* If electrical contact to one of the molds is very poor, the mold will tend to act as a bipolar electrode. This is the most common cause of deplating and is often a consequence of too vigorour air agitation, which loosens the contact intermittently so that one mold will deplate for a while and then another. It is suggested that contacts be made firm.

If the solution is high in acid content and the current density too low, there is also a possibility of dissolving action in the presence of air.

### Rust and Scale Removal

*Question*: We must clean a large amount of fabricated angles, channels and plate which are heavily rusted and deeply pitted. In some cases the rust has formed under the original mill scale, raising the surface into nodes. These parts must be clean enough to admit a deposit of zinc phosphate to 300 mg./sq. ft., the whole process governed by military specification MIL-C-490A — Grade I. We have tried just about everything in the book, including sodium bisulphate, alkaline derusters and chelates and they all fall short of a proper job.

A properly inhibited 10% sulphuric acid bath gives a satisfactory surface but Section 3.4 of above specification forbids its use. Could this be a misinterpretation on our part? Is there any way you could help us?

C. W. P.

*Answer*: Section 3.4 of MIL-490A does not prohibit the use of sulfuric or hydrochloric acid, except on parts which might trap acid in recesses. However, prior authorization or approval is required on all parts unless the part specification or drawing permits use of these acids.

The section says nothing about the use of phosphoric acid, and this material can be tried, unless the parts will trap acid, in which case abrasive blasting would appear to be the only solution to this problem.

### Stained Cadmium Plate

*Question:* The enclosed parts have been cadmium plated in a barrel. This is the stained condition that we find them in after approximately sixty days storage in a large wooden box.

The parts are cleaned in a basket, tumbled in a cadmium solution of 1.5 oz. of metal, 10-12 oz. of sodium cyanide, and 1 oz. of caustic soda.


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After plating the parts are rinsed in a basket through two cold running rinses followed by a final hot water rinse and a hot centrifuge. We have tried several bright dips—nitric, chromic, and several prepared chromate type dips—but still have trouble on parts turning intermittently. Our rinse tanks are dumped and cleaned every night. This trouble occurs primarily with one large account, although we have had an occasional job turn color with other accounts.

If you can offer any suggestions on this matter, it will be greatly appreciated.

G. A. F.

*Answer:* Parts such as the samples forwarded are very difficult to rinse completely in baskets because they tend to stick together when wet. As a result, the flat surfaces are dried with a thin film of salts and, in the presence of moisture from the air, attack takes place after a period of time.

A rotating basket for rinsing may offer relief from this condition, as will smaller basket loads and more vigorous shaking in the rinse tanks.

### Printed Circuits

*Question:* We are interested in plating through holes with copper in a printed circuit board. Our best results have been obtained from dipped graphite coatings, but the results are not always acceptable. We have had varied success with sprayed silver, but this use is contrary to many military and industry specifications because of silver migration. Vacuumizing is too expensive and the results have not been very satisfactory.

There is a temperature limitation because of the adhesive between the copper and the plastic. For that reason we have not experimented with high temperature electroless coatings such as the electroless nickels described in your METAL FINISHING GUIDEBOOK. I do not believe that these metals would coat the plastic hole surface anyway.

One answer to this problem could be an electroless copper, if there is such, which would adhere both to the plastic hole surface and also to the copper outer surface. One reason that many coatings are unsatisfactory is the necessary removal of the coating from the copper surface by difficult sanding which may remove the copper on the rim of some holes.

This problem is a continuing one with this concern. I will appreciate any solutions to this problem that you may have.

R. R.

*Answer:* The usual method of plating in holes on printed circuits is to apply a conducting silver film by immersion or spray.

Reduced copper films of various types have been reported in the literature. After activating with tin chloride solution, as usual, parts are dipped in 1% gold chloride solution and copper precipitated from the following solution:

| | |
|---|---|
| Copper sulfate | 4 g. |
| Caustic soda | 7 " |
| Rochelle salt | 18 " |
| Potassium sulfate | 10 " |
| Water | 1 liter |

15 ml. of formalin are added just before use, as the reducing agent.

An electroless copper bath was reported by *Allen E. Cahill* of the Electronics Div. of General Electric Co. at the recent convention of the American Electroplaters' Society in Montreal.

### Plastics for Chromium Solution

*Question:* Would you kindly inform us on the kind of plastics that will hold up in a chrome plating solution? We use 32 oz./gal. $CrO_3$ solution at 128° F. We are interested in 1¼" piping and fittings and ⅜" thick sheets.

J. L. U.

*Answer:* Unplasticized polyvinyl chloride pipe and fittings are excellent for use with chromic acid solutions.

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## SCIENCE FOR ELECTROPLATERS

(*Continued from page* 64)

state, will not form if the pH value is more than 5.

The theoretical requirements of available chlorine (6.8 pounds) per pound of CN for complete oxidation is obtained as follows: From equation (8) 1 mole CNO is equivalent to 1.5 mole $Cl^-$ or 1.5 mole $Cl_2$, hence 0.03846 (1 pound-mole CN) × 1.5 = 0.0577 mole; .0577 × 71 = 4.095 pounds chlorine. The total pounds of available chlorine required for complete decomposition of one pound of cyanide (CN) is ,therefore, 2.73 + 4.096 = 6.82 pounds. Actually, it is found that 7.35 parts (pounds) of chlorine per part (pound) of cyanide is required.

An example of this two-stage cyanide (batch) oxidation with sodium hypochlorite was described by *B. F. Dodge* and *C. A. Walker* for the treatment of silver-bearing cyanide waste. For this procedure the total cyanide content was determined by a distillation method and the cyanate by a modified Nessler test. The pH of the waste was controlled at a value of about 9, and hypochlorite was added (7.5 parts of available chlorine per part of cyanide and 4 parts of available chlorine per part of cyanate). Oxidation (first stage) of cyanide to cyanate at this pH, with good mixing, resulted in ten to fifteen minutes. At this stage the pH was lowered by the use of waste acid from the plant, to a value of 6.5 to 7.0, when decomposition of the cyanate with the formation of carbon dioxide and nitrogen also was complete in ten to fifteen minutes. An advantage claimed for the two-stage oxidation method is better control of the amounts of available chlorine required for oxidation of both the cyanide and cyanate, thereby avoiding the possibility of using excess reagent. Data collected show that water in the clearwell, after the waste was treated, had a total cyanide content of 0.1-0.3 ppm., a copper content of 0.2 ppm., and zinc less than 0.2 ppm.

### *Acid Hydrolysis*

The study of acid hydrolysis of cyanates was included in the aforementioned research project as a means of reducing the time required for oxidation of cyanates by hypochlorites. The equation for this reaction using sulfuric acid, is as follows: $2NaCNO + H_2SO_4 + 4H_2O \rightarrow (NH_4)_2SO_4 + 2NaHCO_3$. On a molar basis, the equation shows that 1 mole CNO reacts with 0.5 mole $H_2SO_4$; hence 1 pound

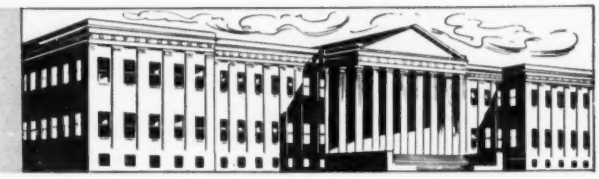
$$\text{CNO (or } \frac{1}{\text{CNO}} = \frac{1}{42} = 0.0238 \text{ mole)}$$

will require 0.0238 × 5 = 0.0119 mole $H_2SO_4$ (or 0.0119 × $H_2SO_4$ = 0.0119 × 98 = 1.17 pound sulfuric acid) for complete hydrolysis of the cyanates.

Results indicated that decomposition of the cyanate was complete within a period of five minutes, if the pH of the solution was not more than 2.5 and the ratio of one-half mole of sulfuric acid to one mole of the cyanate, as represented by the equation (stoichiometrically), was maintained. Dilute solutions containing 500 ppm. CNO or less required more than one half mole of sulfuric acid per mole of the cyanate to reduce the pH value to 2.5 or less.

# Patents

## RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



### Conversion Coating

*U. S. Patent* 2,796,372. *June* 18, 1957. *A. E. Chester and B. R. Jeremias, assignors to Poor & Co.*

An aqueous acidic metal treating solution consisting essentially of 1.5 to 80 grams per liter, calculated as Cr, of dichromate dissolved in an aqueous solution of an acid from the group consisting of hydrochloric acid and nitric acid having a pH not greater than 2.0, a quantity of non-acidic sulfate, calculated as $Na_2SO_4$, to dichromate, calculated as $Na_2Cr_2O_7.2H_2O$, within the range of 1:30 and 1:9 dissolved in said solution, from 2.5 to 25 parts by weight, calculated as sodium acetate, of a lower aliphatic carboxylic acid salt per 90 parts by weight of $Na_2Cr_2O_7.2H_2O$, and a quantity of an inorganic reducing agent which does not form insoluble sulfates in said solution dissolved in said solution in an amount sufficient to reduce at least 0.5% and not more than 5% of the hexavalent chromium in said solution to the trivalent state.

### Zirconium Bath

*U. S. Patent* 2,796,392. *June* 18, 1957. *M. H. Lietzke, assignor to the United States of America*

A process for coating uranium with zirconium which comprises electrodepositing zirconium, from a molten bath consisting essentially of about 30 mol per cent to about 40 mol per cent of a zirconium tetrahalide and about 60 mol per cent to about 70 mol per cent of an alkyl pyridinium halide, onto a uranium cathode having a freshly cleaned surface.

### Stripping Copper Alloys

*U. S. Patent* 2,796,394. *June* 18, 1957. *R. A. Schaefer and G. R. Kingsbury, assignors to Clevite Corp.*

The process of separating and recovering a non-ferrous alloy from a ferrous material coated therewith, comprising: placing a body made up of a nonferrous lead-bearing copper base alloy affixed to a ferrous material in an aqueous electrolyte of the following composition:

| | | |
|---|---|---|
| Copper ions | g./l | 10-50 |
| Lead ions | g./l | 0.5-5 |
| Other nonferrous alloy metal ions | g./l | 0.0-15 |
| Alkali metal hydroxide | g./l | 5-50 |
| Free alkali metal cyanide | g./l | 2.5-15 |
| Alkali metal carbonate | | Substantial |
| Tartrate radical—OOC—CHOH—CHOH—COO— | g./l | 5-20 |

and passing electric current between said body as anode and a cathode structure, the anode-cathode potential being maintained at a value producing a potential drop of less than about 0.8 volt between said anodic body and the portions of the electrolyte in the vicinity thereof.

### Coating Composition

*U. S. Patent* 2,798,014. *July* 2, 1957. *G. N. Bruxelles, assignor to Hercules Powder Co.*

A coating composition comprising the reaction product of a solution of 0.5 to 5 parts by weight of chromium trioxide, 1 to 20 parts by weight of phosphoric acid, and 10 to 200 parts by weight of nitrocellulose dissolved in sufficient organic solvent consisting principally of a mixture of lower aliphatic alcohols and acetone to make 1000 parts by weight of total reaction mixture, the amount of said chromium trioxide being less than the amount of said phosphoric acid, said composition being characterized by improved adhesion to metals and the ability to inhibit the corrosion of metals.

### Hot-Galvanizing

*U. S. Patent* 2,797,173. *June* 25, 1957. *J. D. Keller*

The method of heat treating and galvanizing ferrous metal sheet or strip which comprises the steps of passing the strip continuously through a liquid bath of alkali metals of increasing temperature range having the properties of removing iron oxide and impurities from the surface of the strip, returning the strip from the high to the initial low temperature zone of the bath to cool said strip to a temperature approximating the galvanizing temperature of molten zinc and passing the strip continuously through a nonoxidizing substance into and through a bath of molten zinc.

### Coating Steel Strip

*U. S. Patent* 2,797,476. *July* 2, 1957. *T. Sendzimer*

The process of metal coating a steel strip, which comprises applying a molten metal coating to said steel strip and temper rolling said steel strip with said molten metal coating.

### Corrosion-Inhibiting and Fingerprint-Removing Composition

*U. S. Patent* 2,796,408. *June* 18, 1957. *A. E. Brehm and A. W. Lindert, assignors to Standard Oil Co.*

A corrosion-inhibiting and fingerprint-removing composition comprising from about 2.0% to about 10.0% of a preferentially oil-soluble alkaline earth sulfonate, from about 0.5% to about 5.0% of a preferentially water-soluble, sulfonate from about 0.1% to about 1.0% of an alkyl thioether of a mono-basic aliphatic carboxylic acid having not more than 4 carbon atoms in the acid radical and from about 10 to about 24 carbon atoms in the alkyl radical of the alkyl thioether group, from about 3.0% to about 12.0% of a water-soluble oxygenated organic solvent having a flash point above about 100°F., from about 40.0% to about 65.0% of a hydrocarbon solvent having a boiling point of from about 100°F. to about 650°F., from about 5.0% to about 25.0% of a hydrocarbon oil having a Saybolt Universal viscosity at 100°F. of from about 50 to about 1,000 seconds, and from about 2.0% to about 8.0% water.

### Coating Composition

*U. S. Patent* 2,798,009. *July* 2, 1957. *C. W. Gault, assignor to Hercules Powder Co.*

A coating composition, characterized by improved adhesion to metals and the ability to inhibit the corrosion of metals, consisting essentially of the reaction product of a solution of 0.5-5 parts by weight of chromium trioxide, 1-20 parts by weight of phosphoric acid and 1-200 parts by weight of organo-soluble ethyl cellulose, the amount of chromium trioxide being less than the amount of phosphoric acid, said reaction product being dissolved in organic solvent, the concentration of said reaction product being from 3% to 15% by weight based on the total weight of said coating composition .

### Spraying Apparatus

*U. S. Patent* 2,797,963. *July* 2, 1957. *R. W. Wilson, assignor to Wald Industries, Inc.*

In paint spraying apparatus, a shroud comprising a tubular body having a plurality of vertically extending slots formed in the upper portion thereof, said slots defining a series of resilient sections therebetween and further defining means for admitting air into the interior of said shroud, and means for securing said shroud to a paint gun, said securing means including a clamping member engaging said resilient sections for drawing said resilient sections into firm engagement with said paint gun.

### Plating Test Cell

*U. S. Patent* 2,801,963. *Aug.* 6, 1957. *R. O. Hull and J. B. Winters, assignors to Ann F. Hull and Adrian Medert.*

Apparatus for determining the plating characteristics of a plating bath disposed in a plating tank having anode material immersed therein and a cathode busbar comprising a supporting member suspended from the cathode busbar, a hollow trigonal prismatic container having one open side attached to the lower end of the supporting member, a test plate mounted vertically within the container angularly disposed with respect to the open side of the container, and means for conducting current between said busbar and the said test plate and means for measuring the current flowing to said test plate.


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### Electrostatic Coating Method

*U. S. Patent* 2,798,008. *July* 2, 1957. *E. P. Miller, assignor to Ransburg Electro-Coating Corp.*

A method of electrostatically coating articles each having an electrostatically shieldable portion of relatively large area and, spaced from said shieldable portion, an electrostatically shielding portion of smaller area, comprising moving the articles over a fixed predetermined path past and in spaced relation to electrodes located in facing relationship on opposite sides of the article path, one of which electrodes is of ionizing character, maintaining the articles as they pass between said electrodes so oriented that the shielding portion of each article is disposed between the shieldable portion and said ionizing electrode whereby said shieldable portion becomes electrostatically shielded, forming at a point on the opposite side of said ionizing electrode from said path a spray of finely divided liquid coating material, maintaining a high difference of electrical potential between said electrodes and articles to create an electrostatic field between the electrodes and the articles, with said field creating an electrostatic shield over said shieldable portion of an article, propelling said spray approximately normal to said path at the position of closest approach of the path to said formation point toward both said electrodes and past, and in particle charging proximity to said ionizing electrode to cause particles passing the ionizing electrode to acquire an electric charge opposite in sign to that of the articles and thereby to cause a portion of the spray to be electrostatically deposited on article surfaces presented toward said ionizing electrode, with another portion of said spray being propelled toward at least a part of said shielded portion and past said shielding portion with a velocity sufficient to cause deposition on such part of said shielded portion of the last mentioned portion of the spray in spite of the existence of said electrostatic shield, said articles being spaced apart to permit a further portion of the spray to enter the space between the articles and become electrostatically deposited on article surfaces presented towards said other electrode, with all of the portions of the spray being deposited substantially simultaneously to prevent excessive drying of any of said portions.

### Plating Rack

*U. S. Patent* 2,801,965. *Aug.* 6, 1957. *J. J. Monahan, assignor to Western Electric Co.*

A plating rack comprising a rigid frame of conductive material having spaced portions, a flexible member of dielectric material covering the frame against contact with the bath, and a hollow flexible element supported by the frame between the covered portions and normally spaced therefrom to receive articles therebetween, and means whereby the element may be inflated to force the articles against adjacent portions of the flexible member and to cause the element to cooperate therewith to mask portions of the articles leaving only predetermined portions of the articles exposed to the bath.

### Painting Device

*U. S. Patent* 2,798,240. *July* 9, 1957. *C. P. Jaehne*

A painting device comprising a receptacle for fluent material having a longitudinal axis and having an opening at one end thereof, an apertured cover for said opening inclined at an oblique angle with reference to the longitudinal axis of the receptacle, a frusto-conical paint roller, and means carried by said receptacle for rotatably mounting said roller substantially in contact with said inclined cover.

### Coating Composition

*U. S. Patent* 2,798,015. *July* 2, 1957. *D. K. Lesser, assignor to Hercules Powder Co.*

A coating composition, characterized by improved adhesion to metals and the ability to inhibit the corrosion of metals, consisting essentially of a dispersion product of a solution containing 1 to 50 parts by weight of phosphoric acid in admixture with the product obtained by milling 1 to 60 parts by weight of chromic phosphate with an organic solvent solution blend of 10 to 500 parts by weight of organic-soluble ethyl cellulose and 10 to 500 parts by weight of polyvinyl butyral resin, said organic solvent solution consisting of a mixture of lower aliphane alcohols, ketones and water, the alcohols having 1 to 4 carbon atoms, the ketones being solvents for the phosphoric acid solution, the amounts of said alcohols, ketones and water being sufficient for said ethyl cellulose and polyvinyl butyral resin to dissolve in the alcohols and said phosphoric acid solution to dissolve in the ketones, the concentration of said dispersion product from 3% to 20% by weight based on the total weight of said coating composition, said coating composition being prepared at about room temperature.

### Coating Composition

*U. S. Patent* 2,798,016. *July* 2, 1957. *D. K. Lesser, assignor to Hercules Powder Co.*

A coating composition, characterized by improved adhesion to metals and the ability to inhibit the corrosion of metals, consisting essentially of the reaction product of a solution of 0.5 to 5 parts by weight of chromium trioxide, 1 to 20 parts by weight of phosphoric acid, 10 to 200 parts by weight of organo-soluble ethyl cellulose and 10 to 200 parts by weight of polyvinyl butyral resin dissolved in an organic solvent solution consisting of a mixture of lower aliphatic alcohols, ketones and water, said alcohols having 1 to 4 carbon atoms, said ketones being solvents for phosphoric acid solution, the amount of said alcohols being sufficient to dissolve said ethyl cellulose and poylvinyl butyral resin, the amount of said ketones being sufficient to dissolve said phosphoric acid solution, and the amount of said water being sufficient to dissolve said chromium trioxide, said chromium trioxide being added to said solution in the form of an aqueous solution and in an amount less than the amount of said phosphoric acid, the concentration of said reaction product being from 3% to 20% by weight based on the total weight of said coating composition, and said coating composition being prepared at temperatures up to about 50°C.

### Coating Composition

*U. S. Patent* 2,798,017. *July* 2, 1957. *D. K. Lesser, assignor to Hercules Powder Co.*

A coating composition, characterized by improved adhesion to metals and the ability to inhibit the corrosion of metals, consisting essentially of the of the reaction product of a solution of 0.5 to 5 parts by weight of chromium trioxide, 1 to 20 parts by weight of phosphoric acid, 10 to 200 parts by weight of nitrocellulose, and 10 to

200 parts by weight of poylvinyl butyral resin dissolved in an organic solvent solution consisting of a mixture of lower aliphatic alcohols, ketones and water, said alcohols having from 1 to 4 carbon atoms, said ketones being solvents for phosphoric acid solution, the amount of said alcohols being sufficient to dissolve said nitrocellulose and polyvinyl butyral resin, the amount of said ketones being sufficient to dissolve said phosphoric acid solution, and the amount of water being sufficient to dissolve said chromium trioxide, said chromium trioxide being added to said solution in the form of an aqueous solution and in an amount less than the amount of said phosphoric acid, the concentration of said reaction product being from 3% to 20% by weight based on the total weight of said coating composition, and said coating composition being prepared at temperatures up to about 50°C.

### Plating on Beryllium

*U. S. Patent* 2,798,036. *July* 2, 1957. *J. J. Utz, assignor to the United States of America*

A preplating treatment for beryllium and alloys containing a major portion of beryllium, comprising degreasing said beryllium with a ketone, rinsing said beryllium with water prior to evaporation of said ketones, and then subjecting the resulting water-wet beryllium to a cobalt strike in a bath comprising an aqueous solution of cobalt sulphate and ammonium sulfate.

### Electrostatic Spraying

*U. S. Patent* 2,809,128. *Oct.* 8, 1957. *M. R. Miller, assignor to Ransburg Electro-Coating Corp.*

The method of electrostatically atomizing liquid, comprising the steps of forming liquid material into a thin, uniform film, moving said film into an atomizing zone remote from the site of film formation, establishing an electrostatic field over said film in the atomizing zone, and mechanically obstructing movement of said film in the atomizing zone along a line transverse to the direction of film movement to deform said film locally and thereby increase the gradient of the field at the site of deformation for forming the deformed liquid into a series of cusps and electrostatically atomizing liquid from the tips of such cusps.

### Shielded Roller Painting Device

*U. S. Patent* 2,799,886. *July* 23, 1957. *A. J. Brunelli and S. J. Mortaro.*

The combination of a roller painting device for applying coating material comprising a handle, a bifurcated supporting structure including an interconnecting member carried by said handle, a roller journaled for rotation on said interconnecting member and having an outside surface adapted for transferring coating material thereon to a surface over which said roller is rolled, and a shield comprising a flat member, one edge of which is of flattened arcuate shape and the other edge of which is straight, said shield hinged along its straight edge to said supporting structure alongside one end of said roller, said shield being larger than the adjacent half section of said roller and positioned in offcenter relation thereto.

### Antifouling Paint

*U. S. Patent* 2,800,412. *July* 23, 1957. *Y. Shiraishi, assignor to Osaka Kinzoku Kogyo Co.*

An anti-fouling paint consisting essentially of varnish, pigment and an *w*-fluoroalkyl compound selected from the group consisting of *w*-fluoroalkanoic acids, *w*-fluoroalkyl alcohols, salts of *w*-fluoroalkanoic acids, *w*-fluoroalkyl nitriles, *w*-fluoroalkyl esters, *w*-fluoroalkyl ethers, *w*-fluoroalkyl acetals, *w*-fluoroalkanoic acid amides, *w*-fluoroalkyl hydrazides, *w*-fluoroalkyl ketones, *w*-fluoroalkyl aldehydes and *w*-fluoroalkyl amines.

### Anti-Splash Shield for Paint Pans

*U. S. Patent* 2,798,239. *July* 9, 1957. *H. L. Freund.*

In combination, a paint-receiving tray containing a dip-type roller assembly having a paint roller and a handle, said tray having means for retaining the paint roller assembly in the tray.

### Surface Marking Apparatus

*U. S. Patent* 2,798,765. *July* 9, 1957. *R. W. Wilson, assignor to Wald Industries, Inc.*

In apparatus for marking a surface, means for generating a spray of paint, means for controlling said generating means, said controlling means including a cam, said cam having a predetermined contour defining the operating cycle of said generating means, means for rotating said cam, means for moving said cam to an inoperative position, and means engaging said cam for returning said cam in the inoperative position thereof to a zero position when said operating cycle is incomplete.

### Spraying Apparatus

*U. S. Patent* 2,798,766. *July* 9, 1957. *E. O. Norris.*

A spray device comprising a fixed casing, a hollow shaft mounted for rotation therein, a head carried by said shaft having a peripheral wall provided with openings spaced therearound through which material is sprayed, a fixed feed pipe for said spray material disposed within said hollow shaft, a nozzle communicating with the end of said feed pipe within said rotating head, said nozzle having a discharge opening disposed adjacent the inner peripheral surface of said head in registration with said first openings to discharge the spray material from said nozzle directly into said first openings for spraying whereby the major portion of the spray material from said nozzle directly into said first openings for spraying whereby the major portion of the spray material is sprayed outwardly in a limited peripheral segment around said head.

### Aluminum Oxide Films

*U. S. Patent* 2,798,037. *July* 2, 1957. *P. Robinson, assignor to Sprague Electric Co.*

The process of forming an insulating layer of oxide upon aluminum comprising the steps of anodically forming a porous layer of oxide upon the aluminum, electrodepositing a coating of aluminum within the pores of the oxide layer, and converting said deposits into the oxide.

### Pickling Waste Treatment

*U. S. Patent* 2,798,802. *July* 9, 1957. *T. K. Roy and L. N. Allen, Jr., assignors to Chemical Construction Corp.*

A method for the treatment of waste ferrous sulfate liquors containing ferrous sulfate and sulfuric acid which comprises neutralizing said liquors with lime, heating an aqueous slurry of the resulting precipitate with carbon dioxide and ammonia and thereby converting its calcium sulfate content to calcium carbonate and simultaneously forming ammonium sulfate in solution, and separating and drying the resulting mixture of calcium carbonate and iron hydroxide.




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### Conversion Coating for Aluminum

*U. S. Patent* 2,789,829. *July* 9, 1957. *N. J. Newhard, Jr. and J. A. Carroll, assignors to American Chemical Paint Co.*

In the art of coating aluminum by subjecting it to the action of an acid aqueous solution, the essential coating producing ingredients of which are fluoride ions, dichromate ions, and ions from the class of acids consisting of phosphoric and arsenic acids; the method which includes treating a surface so coated with an acid aqueous solution containing, as its essential active material, a mixture of chromic acid and a fluorine bearing compound from the class consisting of hydrofluroic acid, sodium fluoride, ammonium bifluoride and potassium fluoride; the concentration of the chromic acid being from 1 to 10 grams per liter and of the fluorine from the fluorine bearing compound from 0.01 to 2.0 grams per liter and the pH of the solution from 1.6 and 2.8.

### Conversion Coating for Aluminum

*U. S. Patent* 2,798,830. *July* 9, 1957. *N. J. Newhard, Jr. and J. A. Carroll, assignors to American Chemical Paint Co.*

In the art of coating aluminum by subjecting it to the action of an acid aqueous solution, the essential coating producing ingredients of which are fluoride ions, dichromate ions, and ions from the class of acids consisting of phosphoric and arsenic acids; the method which includes treating a surface so coated with an acid aqueous solution containing, as its essential active material, a mixture of chromic acid and a fluorine bearing compound from the class consisting of fluosilicic acid, fluoboric acid, fluozirconic acid, fluostannic acid, fluotitanic acid and their soluble salts; the concentration of the chromic acid being from 1 to 10 grams per liter and of the fluorine from the fluorine being compound from 0.25 to 10 grams per liter and the pH of the solution from 1.3 to 3.0.

### Silver Plating Titanium

*U. S. Patent* 2,798,843. *July* 9, 1957. *G. W. Slomin and M. P. Christensen, assignor to Rohr Aircraft Corp.*

The method of coating a workpiece composed of a metal of the group consisting of titanium and zirconium, said metal being covered with a thin film of its oxide, which comprises the steps of immersing the workpiece in an aqueous solution of fluoboric and hydrofluoric acids to dissolve the oxide film; removing the workpiece from the solution, while the workpiece is still wet immersing it in a solution consisting of water, fluoboric acid and silver fluoborate; and passing electric current through the solution in a direction to deposit the silver thereof on the workpiece.

### Conversion Coating for Zinc

*U. S. Patent* 2,799,601. *July* 16, 1957. *H. J. Hartman, assignor to Allied Research Products, Inc.*

As aqueous acidic solution for passivating and improving corrosion resistance of zinc surfaces comprising (1) a member of the group consisting of chromic acid and water soluble salts thereof in an amount equivalent to 3 to 100 g./l. $Na_2Cr_2O_7.2H_2O$; (2) a member of the group consisting of boric acid and water soluble salts thereof in an amount equivalent to 1 to 35 g./l. of $H_3BO_3$; (3) a member of the group consisting of hydrochloric acid and water soluble salts thereof in an amount equivalent to 0.1 to 20 g./l. NaCl, and (4) a member of the group consisting of nitric acid and water soluble salts thereof in an amount equivalent to 1 to 10 ml./l. $HNO_3$ (42° Bé.), said solution having a pH between about 0.2 and 4.

### Fused Bath Cleaning

*U. S. Patent* 2,800,420. *July* 23, 1957. *R. Dunlevy, H. Frick and J. H. Shoemaker, assignors to Kolene Corp.*

The method of continuously cleaning metal strip comprising continuously passing said strip through a molten bath of an alkali metal inorganic compound reactive with the surface of the metal and impurities therein; whereby the cleaned strip emerges from said bath with a molten film coating of said alkali metal compound, squeezing the excess of said molten compound from said strip as it emerges from said fused compound bath while maintaining the strip hot by reflecting thereon heat radiated from said bath to prevent cooling of said strip and simultaneous congealing of said molten compound film thereon and guiding said strip into an aqueous quench bath to quickly cool the hot strip and dissolve said compound film, said aqueous quench bath being mounted closely contiguous to said molten compound bath whereby said strip heated as it passes between the two baths enters said quench bath at a rate timed to maintain its molten compound film in a liquid state.

### Conversion Coating

*U. S. Patent* 2,800,421. *July* 23, 1957. *E. W. Goodspeed and G. W. Dell, assignors to Parker Rust Proof Co.*

A process for treating the surface of stainless metals selected from the class consisting of iron, chromium, nickel and alloys of at least any two of these metals which comprises the step of contacting a surface of the metal with an aqueous bath consisting essentially of water, oxalic acid, at least one activating ion selected from the class consisting of halide ions and thiocyanate ions, and an organic compound which contains the nitro group in an amount sufficient to increase the ability of said bath to form a coating on said surface, for a time sufficient to form an adherent protective coating thereon and at a temperature within the range from approximately room temperature to approximately 190°F.

### Method of Chromium Plating

*U. S. Patent* 2,800,436. *July* 23, 1957. *J. E. Stareck, E. J. Seyb, Jr. and F. Passal, assignors to Metal & Thermit Corp.*

A method for reducing the loss of fatigue strength following chromium plating of an article of steel having a fatigue strength of 60,000 to 110,000 p. s. i., comprising electrodepositing chromium on the article by passing a current of 1 to 6 a. s. i. to said article as cathode in an aqueous bath having a $CrO_3$ content of 500 to 700 g./l. and containing dissolved sulfate, $SO_4^=$, as catalyst at a temperature of 120 to 150°F., said bath containing calcium sulfate as the source of said dissolved sulfate, the amount of calcium sulfate being sufficient to saturate the bath and to provide an undissolved excess of calcium sulfate, said bath also containing a soluble calcium compound in an amount sufficient to suppress the concentration of dissolved sulfate from the unsuppressed saturation concentration of the latter to a lower value corresponding to a $CrO_3/SO_4$ ratio of 75:1 to 150:1, said bath containing, and being partially neutralized by, a quantity of dissolved M, where M is a metal having a basic reaction and is selected from the group consisting of sodium, potassium, ammonium, and calcium, said quantity of dissolved M being sufficient to neutralize about 10 to 75% of said bath, plating chromium on the article to form a coating about 2 to 15 mils thick, heating the plated article to a temperature of 350 to 550°F. for about 2 hours, and thereby producing a chromium plated article of said steel having a fatigue strength of at least 90% of that of the unplated original steel.




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# ABSTRACTS

### Mechanism of Chromium Plating

A. I. Levin: *Doklady Akademii Nauk* (Russia). Vol. 95, No. 1, p. 105.

An experimental study is discussed which had the objective of clarifying the mechanism of the reduction of chromate anions during the electrolysis of aqueous solutions of chromic acid, with particular reference to the relation between the current and potential. The metals utilized as the cathode were platinum, chromium, nickel, silver, copper, and zinc.

The experimental method is given. Polarization curves are given for chromium, nickel, zinc and copper. Curves and figures are given showing the relationship between the current density and the cathode potential. The influence of the foreign cations in the electrolyte on the potential of the reduced ions is presented together with interpretations of the results. Their correlation is discussed with the experimental data of other workers on this subject. Finally, there is discussed the conclusions to be drawn as regards the possibility of a direct reduction of the chromate anions at the cathode.

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### Emulsion Degreasing

A. Pollack: *Metallwarenindustrie und Galvanotechnik*. Vol. 47, No. 12, p. 534.

Emulsions of heavy hydrocarbons such as petroleum or solvent naphtha are used for degreasing. This treatment has been found particularly satisfactory before phosphating. It has been found from experience that the trace of petroleum hydrocarbon film, which remains after degreasing, facilitates the formation of particularly fine-grained phosphate coatings with enhanced corrosion-protective properties. The cleaner is generally supplied as a concentrate with 50 to 60% solvent portion, balance water with a small proportion of emulsifier. This concentrate is diluted for use, with water in the ratio of 1:50 to 1:100. With such great dilution, spray emulsion cleaning processes can be operated only at 50° to 80°C.

Emulsion degreasing is conducted in the same metal washing machines as are usual for alkaline cleaning. As compared with alkaline degreasing, the process is simplified, inasmuch as careful rinsing is not as necessary. Accordingly, generally only a single rinsing stage is necessary, which saves in installation costs.

Originally, soap-type emulsifiers were used of the tri-ethanolamine stearate or oleate type. Later, the trend was to non-polar products, such as ethylene oxide condensation products of oxy-fatty acids, amides, etc. Non-polar emulsifiers have the advantage that hard water can be used. In addition, acids, passivating agents, inhibitors, etc., can also be added to the cleaner, so that a derusting can also be associated simultaneously with the degreasing. With the addition of passivating media or passivating acids such as phosphoric acid, it is possible with one single solution, then to degrease, derust and passivate.

No absolutely clear explanation has yet been provided for the mechanism of the chemistry of emulsion degreasing. With the extremely low solution concentration used, no true solution of the grease coating can be assumed, as with cleaning with the concentrated chlorinated hydrocarbons. It is definite that the grease is emulsified. Cleaners which contain only emulsifiers and no hydrocarbons, are less effective. Presumably, a "loosening" (peptizing) of the grease takes place through the solvent medium and then, with the aid of the mechanical action of the spray jet stream, the grease coating is removed and emulsified.

In the concentrated form, emulsion cleaners can also be used for dip cleaning. Sometimes what are termed di-phase cleaners are used, which consist of a mixture of an emulsifier and a solvent medium.

### Electrolytic Cleaning

P. Westphal: *Metallwarenindustrie und Galvaotechnik*. Vol. 47, No. 12, p. 539.

As electrolytic cleaning provides the last working stage before plating it has a great significance on the quality of the plated metal coatings. Usually, a hot alkaline cleaning or a solvent degreasing precedes, the electrolytic degreasing then serves to provide a perfectly clean metal surface. This effect is given by a vigorous generation of gas bubbles at the metal surface being cleaned and, depending on whether anodic or cathodic cleaning is employed, this gas will be either hydrogen or oxygen.

In cathodic degreasing, there occurs a lively migration of alkali ions as well as hydrogen ions to the surface of the part being treated. In this way there is formed a cathodic, strongly alkaline electrolyte layer which, in turn, exerts a strongly emulsifying action on the oil, grease, and dirt. This, with a suitable composition of the bath, ensures that the foreign bodies removed from the surface are distributed in the bath and peptized, so that they cannot again reach the cleaned surface. The use of a hot bath is more favorable in this respect because a more rapid and better emulsification of the grease is obtained. In addition, a further advantage is that a hot bath has a greater electrical conductivity and, consequently, possesses a greater throwing power.

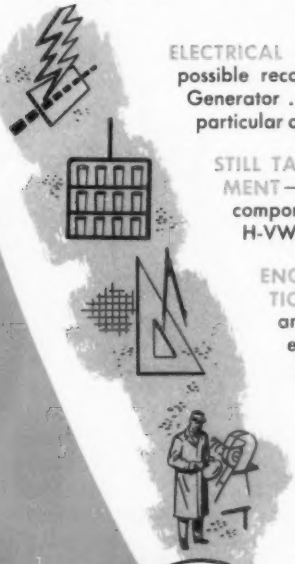
In modern baths it is preferred to have large amounts of alkali silicates, generally metasilicates, as well as alkali hydroxides. In addition, phosphates are often used. The latter render harmless the hardness compounds of the water and also, apart from a relatively high alkalinity, many phosphates such as trisodium phosphate have the characteristic of emulsifying fats and oils. Phosphates can also be more easily rinsed off the surfaces than caustic soda solutions; the latter adhere obstinately at the rinsing stage. Sodium salts are generally used for electrolytic cleaning baths because of lower cost. Potassium compounds have many advantages, however, such as greater solubility, better cleaning action with the same molecular concentration, and greater electrical conductivity.

Neutral electrolytic cleaning baths have recently been developed. These work at a pH of 6-8 with current densities of 4-8 amp./sq. dm. A neutral alkali salt such as sodium sulfate is used as the electrolyte together with a wetting agent. Emulsifying agents also facilitate the degreasing action of the bath. These baths are suitable for cleaning all metals because of their neutral action and may be regarded as a universal bath. The baths can be used both cathodic and anodic, but the combined cathodic-anodic cleaning

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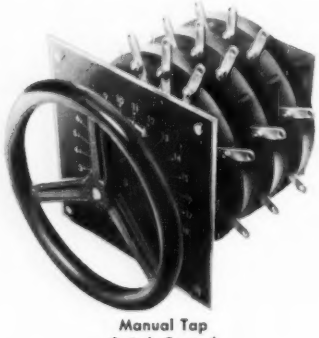


Remote Controlled Rectifier with Tap Switch Control

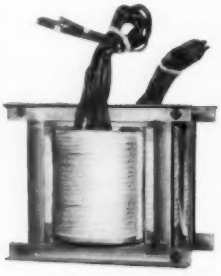
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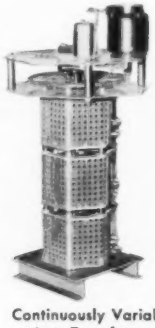
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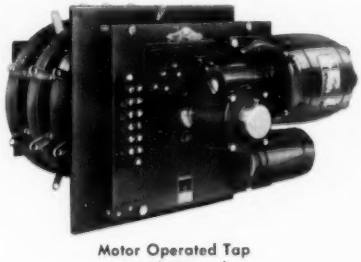
Manual Tap Switch Control



Saturable Core Reactor



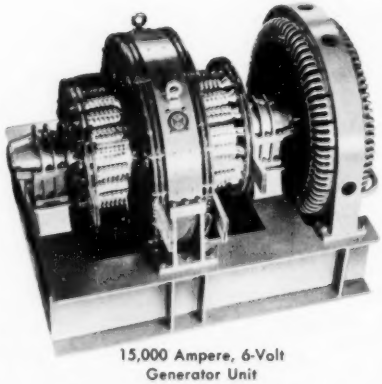
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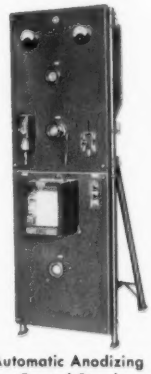
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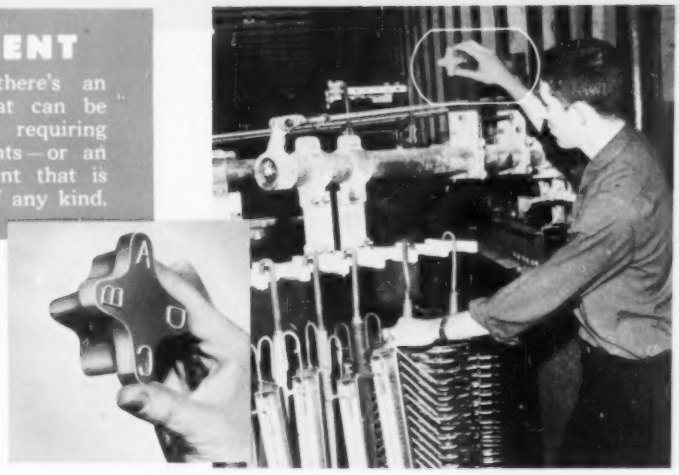


Automatic Anodizing Control Panel

# Supplies, Equipment and Services Add Up Simplicity of Operation in Your Plant

## PROCESSING EQUIPMENT

Whatever your anodizing procedure, there's an H-VW-M Full Automatic Conveyor that can be adapted to any production application requiring automatic cycling of individual treatments—or an H-VW-M Tank with accessory equipment that is perfectly adapted to still tank methods of any kind.



Workman "dials" desired cycle in refrigerator plant. Parts will by-pass or lower into baths as dial setting dictates.

## Automation in Metalfinishing— *Full Automatic Conveyors with Dial-A-Cycle*

H-VW-M's new DIAL-A-CYCLE system automates nine or more complete metalfinishing processes on a single anodizing or electroplating machine. This revolutionary by-pass mechanism can be used on any metalfinishing installation for anodizing, electroplating, or similar processing. It is especially useful and effects substantial cost reductions when a variety of parts requires several different processes or colors.

DIAL-A-CYCLE, as the name implies, is controlled by a simple dial setting. The dial is mounted on the carrier arm that carries the parts through processing tanks. It is set by the machine operator for the processing steps through which each load of unfinished parts is to move. Automatic conveying then takes over, lowering the parts into the required tanks and bypassing others.

Different products, requiring different anodizing cycles, may be processed at the same time, with the same equipment. DIAL-A-CYCLE gives you new versatility while reducing operating, labor, and maintenance costs. Close, automatic control of transfer and immersion periods improves quality.

DIAL-A-CYCLE is the newest of many types of conveyors and equipment H-VW-M supplies to aluminum finishers. H-VW-M also design, manufactures, and installs return-type conveyors . . . elevator conveyors . . . straight-line conveyors . . . and others. For a complete description of all types, write for Bulletin FA-105.

## *Tanks and Equipment*

At H-VW-M—the plating and anodizing industry's workshop—you'll find tank equipment for every phase of your work. For chromic acid anodizing, H-VW-M double electric welded unlined steel tanks are offered, along with steel coil equipment for cooling and heating. The entire system is H-VW-M designed, supplied and installed. For sulphuric acid anodizing, lead-lined steel tanks, plus the necessary cooling coils and air agitation assembly, are supplied. Tanks are fabricated from hot rolled steel, stainless steel, and aluminum. Other types of tanks are also available. Bulletin No. T-108 gives full particulars about this important H-VW-M equipment. Every conceivable type of auxiliary equipment is engineered and supplied, according to customers specifications, including a complete packaged refrigeration system for anodizing solutions.

## *And* H-VW-M's Engineering and Installation Service

Anodizing problems of *any* kind? H-VW-M is prepared to set up your entire anodizing system from beginning to end—a system made up of components scientifically engineered to work together with utmost efficiency. Because of this, and because of H-VW-M's continuing research and development in every aspect of the anodizing picture, you can be confident that the recommendation you receive from H-VW-M is the very *best*.

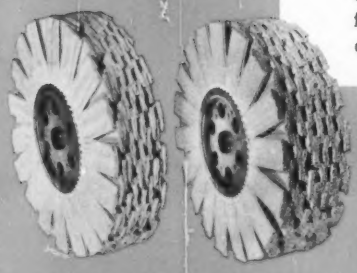
What's more, if requested, H-VW-M sees to it that the equipment you buy is H-VW-M *installed*. This means perfect, efficient operation from the start.

Add to this the fact that an H-VW-M technical representative—ready to serve you—is no further than your telephone. These representatives serve in principal cities across the nation. Get to know the one nearest you. He can help you get the most from your aluminum finishing equipment and supplies.

**TURN THE PAGE FOR ALUMINUM BUFFING AND CLEANING SUPPLIES**

# ALUMINUM BUFFING AND CLEANING SUPPLIES

Since aluminum came into its own after World War II, considerable H-VW-M research and development work has been devoted to the perfection of buffs and compounds suiting the unique physical characteristics of this popular light metal. When long-wearing H-VW-M Buffs are used in conjunction with H-VW-M compounds especially formulated for aluminum finishing, you have the perfectly balanced combination for economy, efficiency and quality performance.



## Buffs

Nowhere will you find a wider selection of the buffs you need for preanodizing operations than at H-VW-M. Whether you're looking for a super-heavy-duty buff like new steel-centered Ruff-L-Buffs (which are available untreated, or Binderized® for extra long wear) medium duty buffs like Triplex Buffs, or a buff for medium-to-light service such as the Full Disc Buff, you need look no further than H-VW-M. The full H-VW-M line also includes new Tufta-Flex Buffs (cloth tufts) and Sisal-Flex Buffs (with sisal-centered tufts).

Among this array you'll find the exact buffs for your aluminum finishing needs. Every one is characterized by first quality, uniform new material of close weave and good weight . . . tight sewing with heavy thread . . . and proper balance. Write for 12 page Bulletin B-103, which describes H-VW-M's entire buff line.

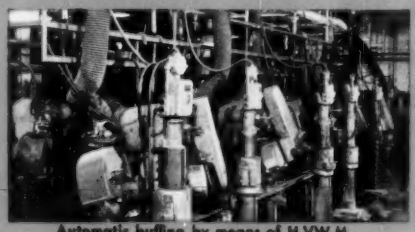
## Compounds

For heavy duty cutting, H-VW-M Liquid Tripoli Compounds 303 and 420 were developed, and are now widely used in the cooking utensil industry. For the appliance, storm window, construction materials and automotive fields, H-VW-M's new Liquimatic Liquid Compound No. 728 has proved especially successful, giving excellent cut, while leaving the surface with deep, high color.

H-VW-M Bar Compounds also find broad use in aluminum finishing. A variety of tripoli bar compounds are offered in varying consistencies to meet all cutting requirements. For cut and color, special white compounds are available. And for high color, several new H-VW-M aluminum oxide compounds—No.'s 6-B-168, 6-B-72 and 8390—give unusually good results. Write for Bulletin CO-103.



Hand buffing using H-VW-M buffs, compounds.



Automatic buffing by means of H-VW-M Liquimatic System.

## Cleaners

H-VW-M devotes constant research to the subject of cleaners in its search for ever better products in the aluminum finishing field.

Matawan Cleaners are designed specifically to give superior results in soak cleaning, power spray operations, oxide removal, and for special aluminum cleaning and etching operations. Of particular interest is H-VW-M's 858 Cleaner, which prevents scale formation, thus keeping coil and tank walls scale free. This unusual aluminum cleaner leaves an extremely bright surface, and, because of its built-in regenerator, makes maximum effective use of caustic in the bath.

In line with its desire to supply the exact cleaner for the job, H-VW-M offers its extensive laboratory facilities where circumstances demand a special cleaner.

When you think of aluminum finishing equipment and supplies—think of H-VW-M first. Buying from one dependable source . . . H-VW-M . . . means one company assumes full responsibility—your guarantee that you're getting the best . . . in products . . . in performance, in *extra* service.

PLATEMANSHIP

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

**HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, N. J.**

*Plants:* **Matawan, N. J. • Grand Rapids, Mich.**

*SALES OFFICES:* Anderson (Ind.) • Baltimore • Beloit (Wisc.) Bridgeport • Chicago • Cleveland • Dayton • Detroit • Grand Rapids • Los Angeles • Louisville • Matawan • Milwaukee New York • Philadelphia • Pittsburgh • Plainfield (N. J.) Rochester • St. Louis • West Springfield (Mass.) • Utica Wallingford (Conn.)

# H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

4758

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is to be preferred. Heat is not necessary here.

Chlorides and other halogens should not be present in electrolytic cleaning baths; soaps and colloids should also be avoided.

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### Ultrasonics in Metal Cleaning Processes

K. Tesser: *Metallwarenindustrie und Galvanotechnik*. Vol. 47, No. 12, p. 552.

When considering the application of ultrasonics to metal cleaning, it is useful to consider the various and separate stages of the metal cleaning process. For example, it may be of use to apply the ultrasonic treatment to one stage only, rather than to adopt an overall-stage ultrasonic cleaning treatment. For the correct applications of ultrasonics also, it is necessary to have a clear understanding of the action mechanism of the ultrasonic waves in a fluid.

The ultrasonic generated vibration waves spread in a straight line from the generation point. Ultrasonic waves are transmitted in a liquid at a speed of about 1,200 meters/second and in a solid body at about 4,000 meters/second.

If a solid body such as a component part is moved inside the supersonic field in a liquid, it is subjected to the following influences. Because of the very rapid vibrational movement, the liquid is flung against the solid body and then again recedes from it. These intensive tensile and compressive forces cause a co-vibration of the body, in the same rhythm. Or, in other words, the body is in resonance with the ultrasonic field. In practice, about 20% of the ultrasonic energy passes through the body.

In practice, there are also influences exerted on the solid body in the ultrasonics field, which have a strong relationship to the ultrasonic vibration number. A rigid body, i.e. one which is almost impenetrable by the ultrasonic waves, generates what is termed a sonic shadow, which is all the more pronounced, the higher the frequency of the ultrasonic field. The bending of the sonic waves around an obstacle is all the more pronounced, the lower the sonic frequency.

The cavitation effect on the solid body in the liquid is dependent on the frequency. Thus, with an ultrasonic frequency of 15 kilocycles, cavitation is generated with a sonic intensity of 0.16 to 2.6 watt/sq. cm. At 500 kilocycles on the other hand, 100 to 400 watt/sq. cm. are generated. The bursting cavitation bubbles also act as local sonic wave generators, with very varying sonic frequencies. In a sonic field which is vibrating at a frequency of 20 kilocycles, it is possible to prove the presence in the field of 10 up to about 500 kilocycles, from this cause. In this case, the formation and bursting of the cavitation bubbles in the fluid takes place 20,000 times each second.

A special action of ultrasonic cleaning is the removal of the dirt which has penetrated into and filled up minute cracks and crevices in the metal surface and which is impossible to remove by any other cleaning means. The cavitation bubbles which are formed at the boundary surface form a hollow space (vacuum). Because of this very low pressure, the liquid which has penetrated into the pores and cracks, together with the dirt present, is spontaneously sucked out. An extremely rapid localized evaporation of the liquid occurs, as when vacuum is applied to a boiling process. The solid dirt particles are, accordingly, violently expelled from the cracks and pores into the cavitation bubble. When it is considered that, with the application of an ultrasonic field of 20 kilocycles per second, this purging effect is taking place at the rate of 20,000 times per second, the amazing effectiveness of the cleansing action obtained will be perceived.

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### Metal Cleaning with Acid Media

A. Pollack: *Metallwarenindustries und Galvanotechnik*. Vol. 47, No. 12, p. 537.

Acid cleaning combines a degreasing action with derusting and often also, a passivation treatment. However it must be realized that the function of an acid bath is not to remove heavy grease coatings—this is the task of an alkaline cleaner or solvent vapor cleaning.

The acid cleaning baths consist mostly of water-soluble organic solvent media such as alcohols, or of emulsified grease removers; an acid constituent which is generally phosphoric acid or acid phosphates: bath inhibitors, and surface-active compounds (emulsifiers, wetting agents). Acid cleaning baths are used almost exclusively as a pre-paint treatment. This type of bath can be divided into several broad classifications:

(1) Phosphoric acid solutions with surface-active compounds, usually wetting agents and water-soluble fat and grease removers, mostly alcohols. These cleaners are used in what is termed the semi-wet process, by which the steel surfaces are wiped with rags soaked with the cleaner solution. This is also called the wipe-off process. Degreasing (to a small extent), derusting and, to a certain extent, passivation are obtained.

(2) Phosphoric acid solutions with a greater portion of emulsifiers (20 to 30%) mostly non-polar products. These solutions can be used in dip or spray cleaning processes at higher temperatures (50° to 80°C.). They are normally diluted 1:2 or 1:3 with water. Amidosulfonic or other acids can be used in place of phosphoric acid.

(3) Solutions of acid salts, particularly the acid phosphates; these are used in combination with emulsifiers. These solutions can be applied only by spray-cleaning processes (pH 5-6). A good degreasing action is obtained but only slight derusting effect and no marked passivation.

(4) Aqueous emulsions of high boiling organic solvents such as petroleum, solvent naphtha, etc., with the addition of phosphoric acid, amidosulfonic acid, oxalic acid, or other organic acids, sometimes also, sulfuric acid. These emulsions, which are produced with acid-stable non-polar emulsifiers can be applied in the dip cleaning process in the concentrated form with 20 to 25% of solvent and with 0.8 to 1.0% solvent in the spray cleaning process.

The treatment processing used, whether dip, spray or wiping by cloths will depend mainly on the shape and size of the parts being treated. The dip process is used only for the smaller sized parts. Spray cleaning is usually adopted for much the same parts in large quantities. Wiping with rags is practiced with parts of large surface area such as car bodies, small boat hulls, ships structures, etc.

Emulsion cleaners with acid addition consist generally of about 50% petroleum with 1 to 2% of a non-polar emulsifier and 50% phosphoric acid solution (about a 45% solution). The two main component parts of the solution are generally mixed together

before use. Diluting to 1:2 to 1:4 for dip cleaning with water, means that the phosphoric acid in this concentration does not act in a passivating manner and, in most cases, an after-passivation is necessary.

### Metal Cleaning with Alkaline Cleaners

H. Rogner: *Metallwarenindustrie und Galvanotechnik*. Vol. 47, No. 12, p. 526.

As regards the action of alkaline cleaners, a differentiation must be made between the purely saponifying action on vegetable and animal oils and greases, and the emulsifying action on mineral oils. Saponification of the neutral fats and greases, under normal conditions with alkaline cleaning, occurs only to a small extent. It is mainly the free fatty acids which are neutralized. The emulsifying action of the alkaline cleaning media is however, of the greatest value. It is also important that the alkaline salts, have an outstanding dispersing and dirt-transporting action for the solid dirt. It is often stated that the cleaning action of an alkaline salt mixture depends on the alkalinity of the bath but this is not true. For instance, a caustic soda solution which shows the maximum alkalinity, as compared with many other alkali salt solutions, has only an inferior emulsifying action on certain oils, such as mineral oils.

The ware being treated also exerts a considerable influence on the composition of the alkaline cleaning medium. With aluminum and its alloys, the cleaning medium should incorporate a sufficient amount of corrosion inhibitors, for example, silicates, in an effective form. The same holds true also for tin, lead, and zinc. Chromates also serve the same purpose. To prevent discoloration of copper and its alloys, the addition of reducing agents is usual.

### Influence of Processing Conditions in Sulfuric Acid on Growth and Characteristics of the Anodic Oxide Coating

D. Lenz: *Aluminium* (Germany). Vol. 32, No. 3, p. 126.

The results of some investigations are given on the influence on the growth and characteristics of the oxide coating. The work was divided into four groupings.

1. It was shown that anodizing procedure (electrolyte, current density, bath voltage, temperature, and treatment time) has considerable influence on the formation and structure of the oxide coating. This applies particularly to the shape and size of the pores, the thickness of the pore-free ground coating and dimensions of the oxide cells and their dome-shaped ground surface. Conclusions can be drawn from this on the optical and chemical characteristics of the oxide coating.

2. The color of the oxide coating is dependent on the material and on the oxidation process chosen. For decorative purpose, the sulfuric acid process is employed. The brilliance of the coating is influenced by the bath voltage, current density and bath temperature. The type of aluminum material also has a certain influence on the brilliance.

3. The chemical stability of the anodized oxide coatings is influenced by the attacking medium, material, coating structure, coating thickness, as well as the sealing process used.

Measurement of the coating thickness, wear resistance, hardness and chemical resistance capacity is important for the control of the finished parts.

It is recommended that, in addition to the aluminum alloy being handled, its condition and its surface pretreatment, precise specifications should be given. These will cover data on the production of the anodized oxide coatings, such as electrolyte composition and concentration, bath temperature, bath movement, voltage, current density, treatment duration, as well as the type, temperature, and duration of the pore sealing process. If the production conditions are continuously controlled, then the certainty is provided of obtaining uniform oxide coatings whose characteristics will conform to the application purpose.

### Patina Coatings on Copper and Copper Alloys

*Deutsche Graveur und Stempel Zeitung*. Vol. 81, No. 3, p. 35.

The composition of the natural patina on copper metals will depend on the surrounding atmosphere. The opinion was previously held that the patina consisted mainly of basic copper carbonates. This applies only to inland regions. Usually, the patina coating consists almost exclusively of basic copper sulfate, $CuSO_4.3Cu(OH)_2$, particularly in the atmospheric environment of large towns. In a purely marine atmosphere, basic copper chloride predominates in the coating.

An extremely large number of formulas are given in the literature for producing various patina coatings on copper by artificial and accelerated means.

The electrolytic process is often very successfully employed for the purpose, and good results are obtained. Unfortunately it cannot be applied to larger sized objects. In addition, its application cannot be recommended for objects whose individual parts have too varying a distance from the cathode as a uniform color is not obtained.

An anodic process involves the use of nitrites as the electrolyte. The ware, which is of copper or copper plated, is treated for about 5-10 minutes at 3-4 volts and a current density of 1 amp./sq. dm. in a solution of 50 g./l. soda ash and 50-75 g./l. sodium nitrite. A copper sheet is used as the cathode, and a very fine and pleasing coating is produced which is protected by brushing with wax.

Another process uses an electrolyte of alkali carbonate and alkali bicarbonate in which the ware is treated at room temperature with an anodic current density of 1-20 amp./sq. dm. The formation of the patina takes place very quickly. In an 8% sodium bicarbonate solution it is formed in less than 1 minute with an initial current density of about 15 amp./sq. dm. The coatings formed in this manner are about as glossy as natural patina and possess the same color tone.

### Progress in Surface Treatment of Magnesium Alloys

G. Siebel: Publication No. 5, *Office National d'Etudes et de Recherches Aeronautiques* (Paris), p. 45.

The anodic processes which have been developed and used in Germany, known as the Elomag, Flussal and Seomag, have attained large scale application for some considerable time now. Industry has not yet decided to which of these three processes should be given the preference.

As regards the anodic process for

producing protective coatings on magnesium alloys, it can be said that, with suitable post-sealing treatment, this represents considerable improvement as compared with the non-electrolyte processes. This progress is not, however, so great as has been attained with aluminum alloys by the anodizing process. This can be ascribed mainly to the different chemical and physical characteristics of magnesium as compared with aluminum and its chemical compounds.

In the opinion of the author, an anodic treatment of magnesium alloys can only be considered primarily for pressure die cast parts for the optical and photographic industries. These, as high value parts, can support an expensive surface treatment of this nature.

There exists in addition, a possibility of application of the anodic treatment process with cast parts which are particularly subjected to corrosion or wear, however, not for sheets which have to be further handled and processed after the surface treatment, as the anodic coatings produced are relatively brittle.

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### Physical Fundamentals and Characteristics of Supersonic Vibrations

Prof. Bergmann: Paper Read at Ultrasonic Symposium, Germany, 1956.

In his paper the author outlined in detail the fundamentals of ultrasonic vibration generation and the application of ultrasonics to industrial processes. The length of the vibration wave is decisive for the intensity of the ultrasonics, which increases with decreasing vibration wave length. The ultrasonic wave generator always radiates the ultrasonic vibrations, vertically to the generating surface.

Increasing frequency signifies decreasing vibration wave length and increasing vibration intensity. The rapidity of the vibration is independent of the frequency. Particles of a medium can be accelerated in an ultrasonic field to a hundred thousand times the value of the earth's acceleration. Accordingly, in an ultrasonic field, extraordinarily strong forces become effective within fractions of a second.

With exposure to supersonic radiation of this nature in a flowing fluid, there is formed a cavitation effect as the result of special pressure relationships, in which cavitation bubbles form burst. The cavitation produced by the supersonics is dependent on the frequency and considerable forces are freed which produce pressures of 1,000 atmospheres at the cavitation areas. In gas-free fluids, these can be raised to more than 10,000 atmospheres. The mechanical action on a surface results from this.

The author stated that the frequency must be determined if it is desired to conduct ultrasonic waves through a separating wall (diaphragm) into a liquid to be radiated with the ultrasonics. The thickness of the separating walls determines the ultrasonic vibration frequency. In conclusion, the various processes and techniques for the production of ultrasonic wave generation were considered.

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### Regeneration of Electrolytes used for Electropolishing Steel — Removal of Iron

T. Zak: *Socha J. Prace Instytutow Mechaniki* (Warsaw). Vol. 5, No. 15, p. 51.

A process is described by means of which iron can be electrolytically removed, with the aid of a diaphragm, from spent electropolishing solutions. If the operation is being conducted with a diaphragm, then correspondingly higher current densities are used, for example, 170-190 amp./sq. dm.





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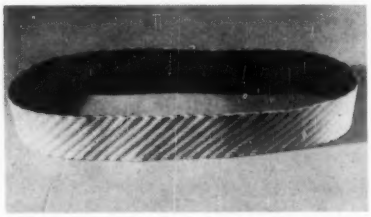
# Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES



### Felt Polishing Belt

*The Shaw Belting Co., Dept. MF, 150 William St., Middletown, Conn.*



Believed to be an innovation in polishing belt design, this felt belt features a ribbed construction which is said to offer improved polishing action, cooler running, excellent carrying of polishing agents and long wear.

The rib design is claimed to result in cooler operation which decreases the possibility of burning or clouding. While rib surfaces become heated, areas between the ribs remain at room temperature. The diagonal ribbed surfaces help the belt to follow difficult contours, especially on round or half-round shapes. As the ribs gradually flatten in use, clean new surfaces are continuously being brought to bear on the work. This increases polishing efficiency and also lengthens the life of the belt. The projection ridges of the face above the ribs make a nap which is highly desirable in polishing. A laminated layer of Orlon eliminates belt stretch. Suitable for a wide variety of polishing and grinding operations, the belt is available in all sizes.

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### Acid Gold Plating Process for Printed Circuits

*Sel-Rex Corp., Dept. MF, Nutley 10, N. J.*

A new acid-type (pH 3.5 to 4.5) gold plating solution, developed specifically for plating printed circuits, is mildly acid so that neither the laminate nor the adhesive at the inter-face of printed circuit boards are affected during the plating process.

Among other advantages claimed for the process are: operates at room temperature—no hot solutions to damage even the less expensive paper or micarta printed circuit baseboards; approximately 75% greater resistance to abrasive-wear than conventional gold plate; smooth, fine-grained, uniformly distributed bright gold plate regardless of thickness requirements; easy to prepare, simple to maintain and control solution.

It is reported that the new acid gold plating process eliminates the need for a conventional "gold strike", avoiding damage to printed circuit board photo resist by exposure to warm cyanide solutions. The new process forms a firmly-bonded, fully adherent gold plate, providing the copper base is properly cleaned, according to the manufacturers.

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### Conversion Coating for Zinc

*Wagner Brothers, Inc., Dept. MF, 400 Midland, Detroit, Mich.*

A new conversion coating for zinc plating produces a bright, clear finish without leaching in processes where maximum corrosion resistance is secondary to bright appearance. According to the company, the resultant finish provided by the coating has a minimum of iridescence, and can be applied over both barrel and rack-plated parts.

The formulation of the coating, called Iso-Lok ZDP, is such as to lend itself to low-cost operations. In making up a typical bath, the basic product, in form of a powder, is mixed with nitric acid (3 pounds of powder to 1½ gallons of acid) for each 100 gallons of working solution.

During the coating operation, the bath is operated between 80 to 100 degrees F, the parts being immersed from 5 to 25 seconds, with slight agitation. Cost of the solution is so low that it can be discarded after two or three rejuvenation additions.

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### Colorless Coating For Metal Surfaces

*Finishes and Coatings Div., Magnus Chem. Co., Inc., Dept. MF, South Ave., Garwood, N. J.*

A coating as colorless as water, for protection of bare non-ferrous metals, and which will restore the color and gloss of faded paint or enamel films, has been field tested for more than 3 years, does not peel or turn yellow as most clear coatings have in the past it is claimed. It is a synthetic, high gloss polymeric finish, not a lacquer, yet it dries in 5 minutes to touch and hard in 30 minutes. It has been used successfully over such metals as aluminum, magnesium, copper and chrome metals as an almost invisible protective coating preventing oxidation, pitting, staining and tarnishing of the metal.

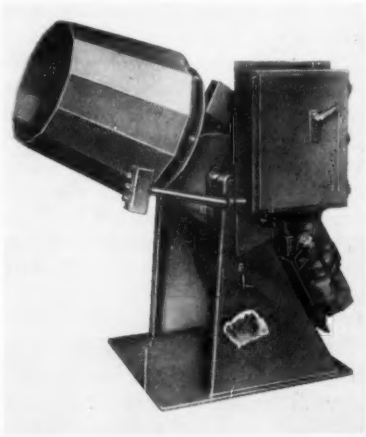
51/Circle on Readers' Service Card

### Barrel Finishing Machines

*The Baird Machine Co., Dept. MF, Stratford, Conn.*

A new series of barrel finishing machines, under the trade name "Poliaction", features complete redesign of pedestals, with new drive and tilting mechanism options to meet production-line requirements.

Machines are available in two sizes: No. 1 for barrels 13" to 22", and No.



# New! ...from H-VW-M

# NI-PLEX A FAST, LOW-COST NICKEL STRIPPING COMPOUND that's EASY on basis metals

Just one NI-PLEX bath strips nickel or cadmium quickly, completely from steel, copper, brass, silver or aluminum—without injuring the basis metal!



UNRETOUCHED PHOTO of wrench plated with H-VW-M Nickel-Lume and chrome. Lower half was stripped with new NI-PLEX. Note clean, clear surface of basis metal—no pitting, no rough spots, no rounded corners!

**NO CYANIDES, CAUSTICS, ACIDS OR CURRENT** ... and no noxious fumes! New Ni-Plex won't cause corrosion or pitting ... tests prove it's the *only* effective nickel stripper that's safe for parts containing two or more basic metals.

**NI-PLEX SAVES YOU MONEY!** Ni-Plex *stays* laboratory-fresh, delivers 100% efficiency in closed tanks, keeps its stability even at high temperatures. Result: Ni-Plex costs average better than *1¢ less than other stripping compounds for every square foot* of 0.0001" nickel stripped! What's more, nickel can be reclaimed when Ni-Plex is used.

**NO PILE-UP OF REJECTS** waiting for a "custom-made" bath! Ni-Plex's *versatility* and *stability* mean you can keep an all-purpose bath standing by, in a clean, covered tank—ready to use as you need it.

**EASY TO PREPARE! Just mix with water, following simple instructions. Use Ni-Plex for stripping racks, too!**

**DON'T MISS THIS OPPORTUNITY** to discover for yourself how new NI-PLEX can solve your nickel stripping problems. Clip the coupon below, and drop it in the mail, today, along with $4.00 for a quantity of NI-PLEX sufficient to make a 1-gallon bath. Try it—and compare the results! Hanson-Van Winkle-Munning Company, Matawan, New Jersey. Offices in principal cities.

**MAIL THIS COUPON TODAY....**

**HANSON-VAN WINKLE-MUNNING CO.**
**Matawan, New Jersey**
**Att. J. W. Carton**

Please send us parcel post prepaid enough NI-PLEX for a 1-gallon bath, along with complete instructions.

☐ $4.00 Check enclosed
☐ Purchase order enclosed

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Address_____

Attention of_____

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2 for barrels 22" to 36". They may be ordered equipped with either push-button "Electratilt" or manual-hydraulic "Hydratilt" barrel control, and with either vari-speed motor or vari-sheave drive. The machines may be equipped with Baird barrels in a full range of sizes and types, or may be used with standard barrels of other makes.

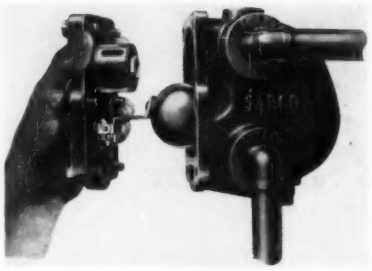
53/Circle on Readers' Service Card

### Float-Thermostatic Steam Trap

*Sarco Co., Inc., Dept. MF, 635 Madison Ave., New York, N. Y.*

Improved, simplified, construction increases the accessibility of this float-thermostatic steam trap, type FT, greatly facilitating inspection, maintenance, and installation. The entire operating element of the new trap is one unit, which can be removed without disturbing inlet and outlet connection to the semi-steel trap body, suitable for 125 p.s.i. steam pressure. Operating elements consist of stainless steel valve mechanism, copper float, and bronze thermostatic air vent.

The valve is designed to provide



condensate seal and prevent loss of steam. Each trap is factory-tested under steam pressure and condensate load conditions to guarantee the proper operation of the float-valve and thermostatic by-pass element.

54/Circle on Readers' Service Card

### Heat Fusible Plastisol

*The G. S. Plastics Co., Dept. MF, 15585 Brookpark Rd., Cleveland, Ohio.*

XL-12 heat fusible plastisol is a bake-on coating for plating and processing equipment, offering measurably superior characteristics of physical - chemical - temperature resistance, according to the manufacturer. It is claimed to exceed the usual standards for this type of coating in durability against abrasion, cuts, wear, and resistance to all normal plating solutions, short cycle vapor degreasing and higher heats. It develops an exceptionally tough, flexible, glossy surface, allowing complete drainage for free rinsing, thus eliminating drag-out and contamination of plating solutions.

The product has low viscosity and high fluidity, yet it affords excellent pick-up on the surface to be coated. These properties overcome the cause of air entrapment during dipping, thereby preventing bubbles and pinholes. Plate-thru and treeing are also eliminated. Much higher heat stability has been achieved, and the new plastisol will not discolor even with prolonged baking. Operators are allowed more latitude in their time-temperature cycle without danger of degrading the coating. The system using primers XL-10 or XL-20 makes a powerful bond to ferrous and non-ferrous metals. Adhesion is not impaired even when exposed to most chemical solutions at room or elevated temperatures.

Standard color is a high-visability




orange, but it can be supplied in any color desired. The plastisol is packaged in metal containers and is compatible with most other plastisol coatings.

55/Circle on Readers' Service Card

### Etch Regenerating Process

*Graham, Savage and Associates, Inc., Dept. MF, 475 York Road, Jenkintown, Pa.*

A process for regenerating spent ferric chloride etch, such as used for etching copper, as in the making of printed circuits, half-tone plates, and textile printing rolls, is also stated to greatly reduce the waste treatment load and effect a substantial saving in chemical use and treatment cost.

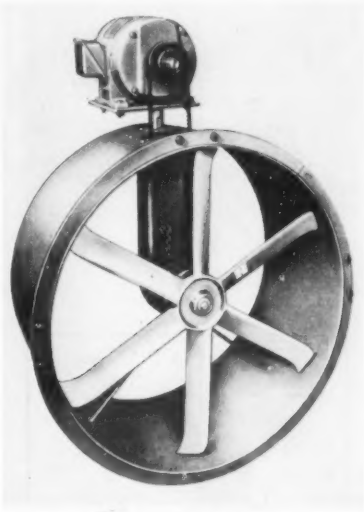
High purity copper is recovered in powder form, while the etch is regenerated at a cost which makes the over-all operation profitable. There is no need to purchase fresh ferric chloride; the cost of the installation is recovered quickly, and the problem of waste treatment is greatly minimized, it is said. The process is the subject of a patent application.

56/Circle on Readers' Service Card

### Belt-Driven Exhaust Fans

*Binks Mfg. Co., Dept. MF, 3122 Carroll Ave., Chicago 12, Ill.*

A new series of belt-driven exhaust fans, available in 18-, 24-, 34- and 42-inch diameters, are designed to provide maximum exhaust per horsepower used.



The fans furnish static pressure from ¼-inch to 1¼-inch. The volume of air moved ranges up to 28,375 C.F.M. This performance is based on average motor speed of 1725 R.P.M. Aluminum fan blades are driven by V-type belts passing through dust-tight housings.

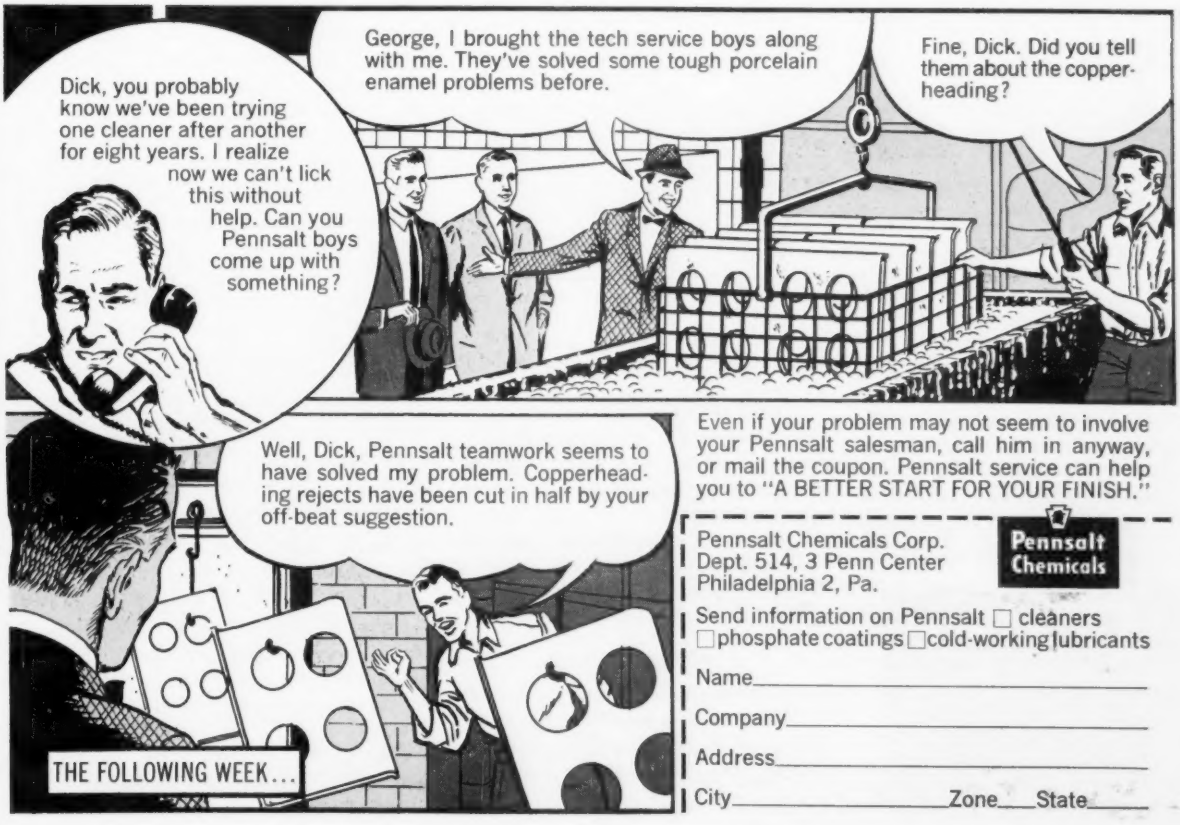
The fans meet fire underwriters specifications. Performance rating is in accordance with the standard test code for centrifugal and axial fans.

57/Circle on Readers' Service Card

### Automatic Barrel Plater

*Belke Manufacturing Co., Dept. MF, 946 N. Cicero Ave., Chicago 51, Ill.*

More uniform distribution of electroplating deposit combined with increased output at reduced cost are features of a new automatic barrel plating machine. Developed especially to provide maximum flexibility, the machine uses horizontal plating cylinders with hanger mounted motor drive. Cylinders are attached by bolting the hanger bridge to the hanger arm of the machine. They are easily changed and cylinders of different types can be used. Machines are available with


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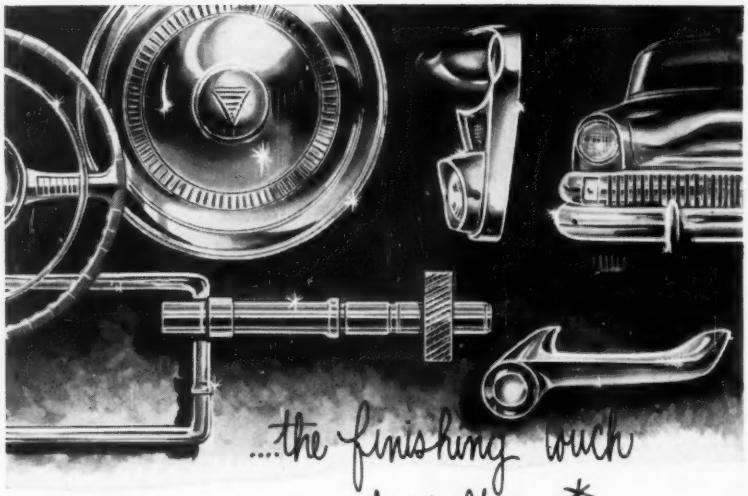
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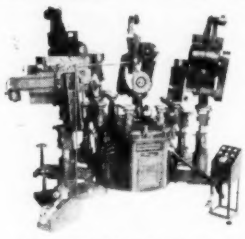
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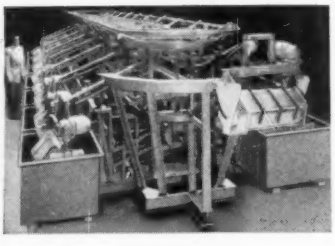
double oscillating or conventional cylinders.

The standard machine has 18 cylinder stations, including 5 plating tank positions. With a 20 minute plating period this machine turns out a completed cylinder every four minutes. Machines with practically any number of cylinder positions can be built to order.

Simple electro-mechanical operation and construction of interchangeable parts means equipment easily adjusted, serviced and maintained by plating plant personnel.

Only 8′ 2″ at the highest point the new machine can be installed under a 9′ ceiling.

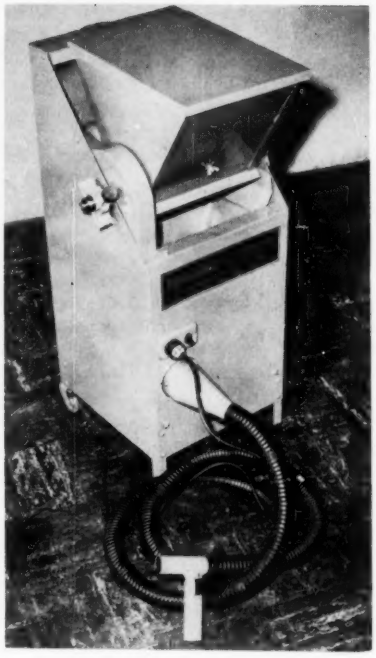
60/Circle on Readers' Service Card



### Flocking Machine

*Progressive Equip. Co., Dept. MF, 8625-29 Mackinaw at Grand River Detroit 4, Mich.*

A new, low-cost, compact flocking machine is designed to handle a wide variety of work. The new flocking machine, the Peco Model 7, has a self-contained air supply to prevent overloading one's present compressor in volume flocking operations. Improvements include a roller chain drive with ball bearing, totally enclosed, overload-protected motor, a long-wearing nylon spiral feed brush, a flexible steel baffle for positive volume control, a separate overload-protected fan motor assembly, and accessories for special requirements.



The compact unit is a rugged, self-contained, production-type machine, yet its 18 gage steel outer case measures only 15″ x 16″ x 39″, and the complete unit weighs less than 100 pounds. The machine is mounted on two casters for easy portability. Thumb control switch on nozzle at end of flexible discharge hose provides finger-tip control of flocking.

61/Circle on Readers' Service Card

### Sealer For Annodized Aluminum

*Sandoz, Inc., Dept. MF, 61 Van Dam St., New York 13, N. Y.*

Sandofix ALU, (patent applied for) is said to be the first non-smutting sealer for anodized aluminum. Advantages of the new sealer, according to the manufacturer, include the following:

Elimination of post-sealing buffing and coloring of anodized products.

Improvement in appearance of those

products which cannot be buffed due to their shape.

No need to control pH of sealing bath under normal operating conditions.

Even black-dyed anodized aluminum can be completely sealed without any appearance of smut.

The material is recommended for use in existing equipment and requires no change in anodizing procedure.

62/Circle on Readers' Service Card

### Bright Brass Bath

*Yorktowne Special Products, Dept. MF, 310 N. Franklin St., Red Lion, Pa.*

A new bright brass process suitable for direct plating on wire goods and hardware, called Sol-Brite, features brilliant yellow deposits at current densities to 300 amperes/sq. ft. with a plating speed of over 0.0001 inches per min. Good leveling action and ease of control are also claimed. Less brightener may be used if the deposit is to be buffed. Conventional brass baths are easily converted.

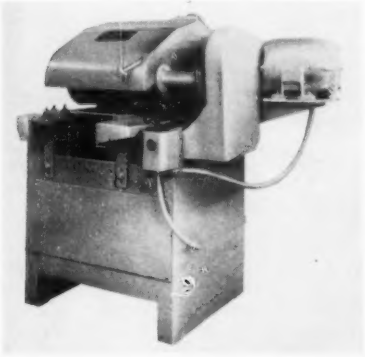
63/Circle on Readers' Service Card

### Belt Polisher

*Timesaver Sanders, Dept. MF, P.O. Box 7446, Robbinsdale Station, Minneapolis 22, Minn.*

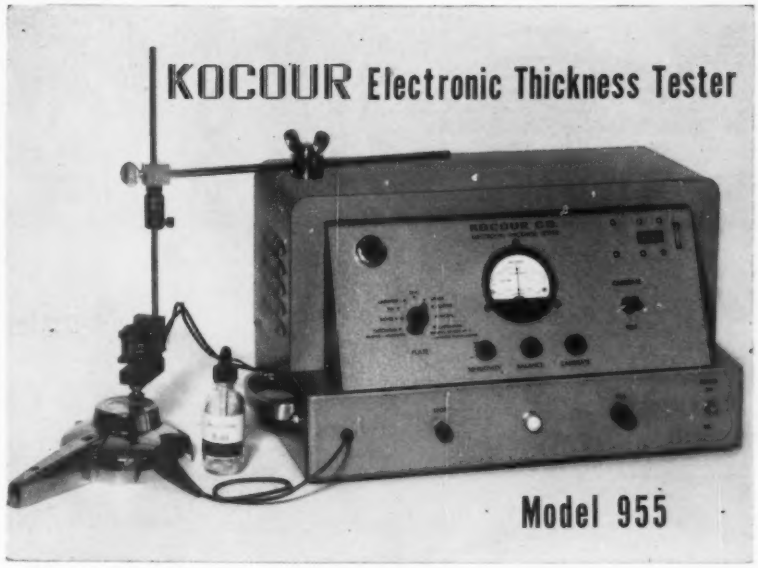
Speedbelt 12" is a handy, versatile abrasive belt machine that can be used on many finishing, sanding and polishing operations now being done by hand. Its compact design, size, and 34" feeding height enable use in production lines where small metal parts are fed by conveyor directly to the machine.

It is available with 3 types of feed tables and can be utilized for many different operations when and where needed in the plant. Positive feed adjustment can be quickly made for any



type material up to 2" thick. For jobs requiring a wider belt this machine is also available as an 18" model.

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**PLATING THICKNESS TESTER PROVES ITS ACCURACY**

**Model 955 features a wider application than most other methods . . . direct readings with an accuracy of 90-95% . . . quick, simple and automatic operation . . . reproducible results and, human error is virtually eliminated.**

**Most important to you is the new calibration feature which is used in conjunction with accurately prepared Kocour Thickness Standards. This feature not only provides a check on the accuracy, but in addition a quick calibration adjustment will automatically correct slightly high or low readings. Thus, you get proven accurate readings direct from the instrument panel.**

**Model 955 may be the answer to your plating thickness problems. Don't hesitate . . . get the details today!**

***Ask for a demonstration or 15-day Free Trial!***

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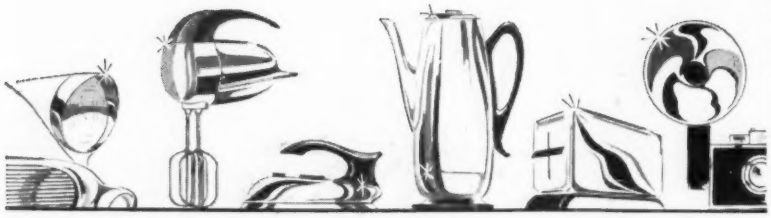

### Zinc and Aluminum Cleaners

*Allied Research Products, Inc., Dept. MF, 4004-06 E. Monument St., Baltimore 5, Md.*

A new line of cleaners has been especially formulated to properly prepare zinc die castings and aluminum for chromate coatings. All are designed to give long bath life and maximum cleaning efficiency. Each cleaner is supplied in powdered form and is completely water soluble. Each contains water-conditioning, anti-foaming and anti-caking agents that assure good rinsability and ease of use.

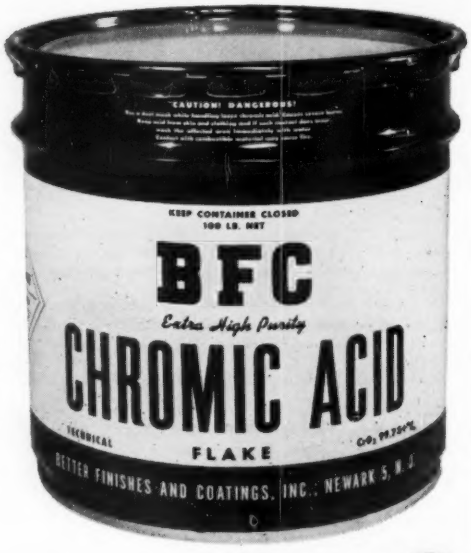
ARP 140, zinc die cast cleaner serves primarily as a non-etch anodic cleaner, but contains an inhibitor which enables it to produce a very fine etch when used as a soak cleaner, without current. This versatile cleaner is extremely free-rinsing, making it an ideal choice in the preparation of zinc die castings for chromating or electroplating.

ARP 150, aluminum etch cleaner is a non-dusting, free-flowing cleaner that produces a uniformly etched finish on all aluminum alloys. A simplified and unique control method developed for this cleaner assures proper etching at a uniform rate, and also gives a more reliable indication of the true cleaner concentration. It prevents the bath from reaching the point where it can no longer hold aluminum in solution. Thus, maximum protection is provided



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**BETTER FINISHES & COATINGS, INC.**
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against the formation of scale on heating coils and tank walls.

ARP 160, non-etch cleaner for aluminum is a white, free-flowing, non-dusting powder that provides a clear solution when made up. It contains a combination of synthetic and natural ingredients for removing all types of soils and greases, and is free-rinsing under all water conditions to enhance the effect of subsequent chemical treatment. It also removes adherent ink markings from all aluminum, and cleans buffed and polished parts without harming the metal gloss. It may also be used for all aluminum cleaning prior to anodizing, phosphating or aluminum etching.

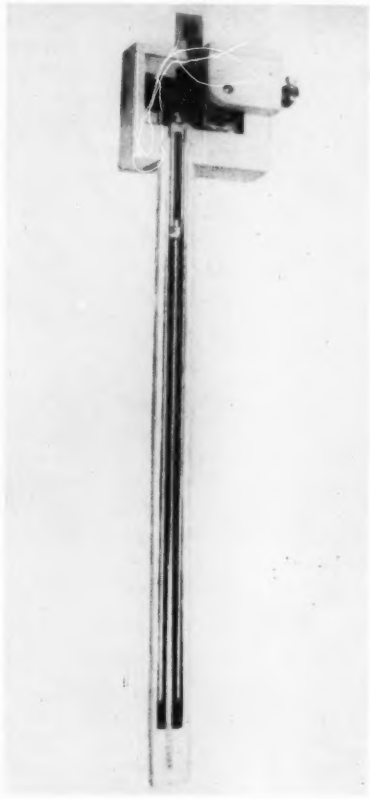
ARP 170, aluminum deoxidizer is especially formulated to provide the best possible preparation of aluminum before chromate treatment. It dissolves all oxides on all alloys and is extremely economical to use. It is a 100% active formula, with no fillers or inert ingredients. It is designed to dissolve oxides and smut on wrought alloys with a minimum of attack on aluminum. It has a self-regulating action that prevents any passive film formations, even after extended immersion.

All four new cleaners are packaged in 125-lb. and 400-lb., full head, lined fiber drums.

67/Circle on Readers' Service Card

### Thermostat

*Elkhart Controls Co., Dept. MF, Elkhart, Ind.*



A new immersion type thermostat has a chemically inert power element which extends into the solution and is constructed of Teflon, to insure against any power element failure due to chemical action.

This thermostat, called the Eltemp Model T-34, can be safely used in any known chemical solution in its temperature range. The unit operates on a differential of 2 degrees or less and has an adjustable range of 70-210° F. The heating or cooling source is regulated by a Minneapolis-Honeywell, Type "Z", double-throw micro-switch.

68/Circle on Readers' Service Card

### Acid Copper Plating Process

*Sel-Rex Corp., Dept. MF, Nutley 10, N. J.*

CuSol, a new acid copper plating process is said to permit faster, smoother, more ductile deposits than any known method. The process consists of two simple addition agents which may be used to "convert" existing sulphate or fluoborate copper plat-

ing baths, as well as to make-up original baths.

Among the advantages claimed for the new process are: exceptional throwing power affording evenly-distributed deposits even in "blind" holes and crevices; high ductility permitting the plate to be buffed as easily as gold; elimination of uneven build-ups and "trees", no need for periodic reverse or "de-plating" methods; and operable in a wide range of current densities, 5-280 amp./sq. ft., permitting adjustment of the speed of deposition in accordance with specific requirements.

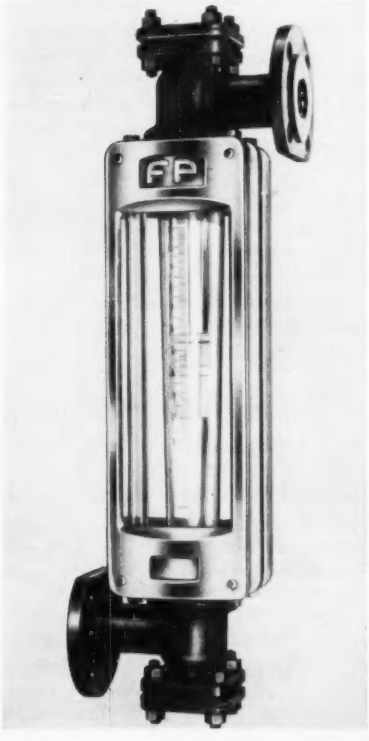
It is reported that the process is expected to be of special interest to printed circuit manufacturers in that the acid base will not affect the laminate boards, as do cyanide-base solutions.

69/Circle on Readers' Service Card

### Corrosion Proof Flowmeter

*Fischer & Porter Co., Dept. MF, 455 Jacksonville Road, Hatboro, Pa.*

A rugged, corrosion-proof variable-area flowmeter has vitreous enamel-lined cast iron fittings. The meter will handle corrosive fluids formerly handled only by rubber-lined, porcelain, hard lead, and special alloy meters. At the same time, it will stand up to temperatures and shocks that meters fabricated of the more fragile materials would not take, it is claimed.



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**Fast, uniform finishing of flat parts!**

Grind and polish metal or plastic parts in one semi-automatic operation! Where high production and consistent finishes are required, look for these Hammond features:

**AUTOMATIC AIR TENSIONING**: maintains correct tension on abrasive belts and conveyor belt.

**VARIABLE SPEED CONVEYOR**: rate of feed is adjustable from 0 to 60 FPM.

**WORK HOLDERS**: hold-down rolls, electro-magnetic platen and various types of conveyor belts.

**AMMETER CONTROL**: an ammeter for each head allows operator to determine and maintain the polishing pressure necessary for a uniform finish and longer belt life.

**V-BELT DRIVE**: allows abrasive belt speed to be changed to suit the work.




*Send samples and production requirements for an engineering report on your finishing job.*

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### Lined Gloves

*Wilson Rubber Co., Industrial Div., Dept. MF, 1200 Garfield Ave., S.W., Canton 6, Ohio.*

The unique comfort feature of a soft lining in an industrial glove is now available in the new Wil-Gard soft-lined natural latex glove, designed for use in most water solutions of acids, alkalies, salts, and in ketones.

Offering all the long-wearing qualities of acid-resistant natural latex, plus new wearing comfort, this new industrial glove provides maximum flexibility and finger sensitivity. A soft cotton fiber lining absorbs hand perspiration. The lined latex glove also features curved-finger design and Firmhold palms and fingers with thousands of tiny gripping surfaces.

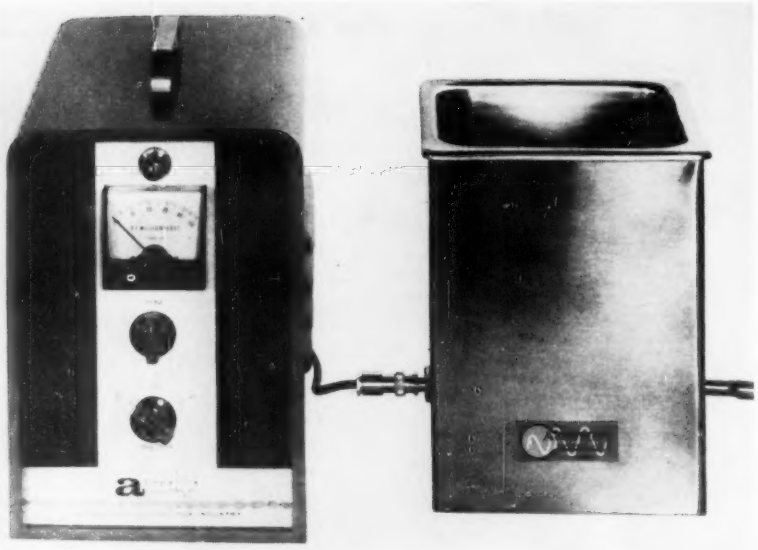
The gloves are available in small, medium, large, and extra-large sizes in 12-inch lengths, with turndown cuffs and tear-resistant pinked wrists.

72/Circle on Readers' Service Card

### Portable Ultrasonic Cleaning Unit

*Acoustica Associates, Inc., Dept. MF, 26 Windsor Ave., Mineola, N. Y.*

Model DR 50-AH ultrasonic cleaning unit is distinctively styled in attractive colors and functionally designed for portability, durability and easy



maintenance. The unit is priced at only $365.00 F.O.B., Mineola, N. Y. A second tank, controlled by the built-in tank selector switch, is available for only $125.00 additional.

The unit consists of a compact generator, and the transducerized tank. The tank, made of 18-8 heavy gauge stainless steel, is corrosion resistant, and has rounded corners for easy cleaning. The generator is 10" high, 7" wide, 10½" deep. The tank is 9" high, 5¾" wide, 5¾" deep and has more than one-half gallon cleaning capacity.

Features include: Outlet tap for hookup with external recirculating filter or temperature control system; light weight, only 25 lbs. packed for shipping; tank can be bench recessed or flush mounted; no limit timer required, although a timer can be attached for special functions; no special wiring or installation required, just plug in to 115 V. AC to operate.

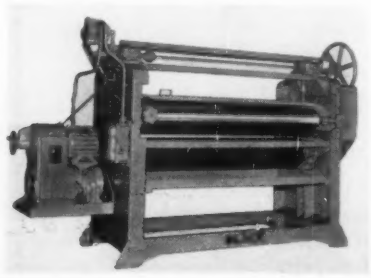
73/Circle on Readers' Service Card

### Roller Coater

*The Black Bros. Co., Inc., Dept. MF, Mendota, Ill.*

The 22-D roller coater is a heavy duty production built coating machine designed to meet the most demanding requirements. It incorporates exclusive features such as: patented safety control, precision ground oversize solvent resistant rolls, larger adjustable opening (0 to 4½") between rolls, micrometer roll adjustments and a wide variety of optional extras. Welded steel frame utilizes box type construction to assure that all moving parts will be held in perfect alignment. The roller coater provides a fast, efficient, economical and convenient means of applying finishes to all types and thicknesses of flat materials. It is available in 21 sizes from 8" through 122" in 6" increments.

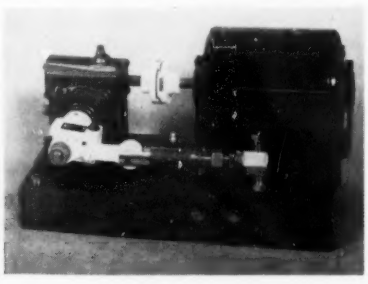
74/Circle on Readers' Service Card



### Metering Pump

*Milton Roy Co., Dept. MF, 1300 E. Mermaid Lane, Philadelphia 18, Pa.*

A new miniPump line of controlled volume pumps for flow rates to 7880 ml. per hour and pressures to 1000 pounds per square inch is ruggedly constructed with motor drive action on the plunger for suction as well as discharge strokes. This pump has a repetitive accuracy of ± one per cent of full capacity. Available with column valve type liquid ends constructed of plastic, Milroy stainless steel or Hastelloy C, the pumps are ideal for accurately metering minute quantities of costly or corrosive fluids.



Driven by ⅓ hp, single phase, 60-cycle, 115-volt electric motors, these pumps may have single or duplex liquid ends. Maximum capacities per liquid end are 300 to 3940 ml. per hour. Their capacities are manually adjustable from 0 to 100% when the pump is idle.

75/Circle on Readers' Service Card

### Strip Coating

*Chemical Consulting Service, Dept. MF, 3711 S. Clement Ave., Milwaukee 7, Wis.*

Strip-Kote is a high solids, milky colored, plastic emulsion which, when dry, gives a transparent, tough film for protecting smooth and wrinkled metal finishes from being marred or scratched during processing, shipment or storage. It is applied by brush or spray gun, and the film becomes transparent as it dries. The dried film is permanently flexible and is easily stripped to preserve that factory-fresh appearance on the protected surface.

The product contains no inflammable solvents. The solid content is 52 per cent, and coverage will vary according to the thickness of film deposited. For example, the coverage is 500 square feet per gallon for an 0.004" film.

76/Circle on Readers' Service Card

### Rust Preventive

*American Oil & Supply Co., Dept. MF, 238 Wilson Ave., Newark, N. J.*

The user can make his own corrosion preventives to meet his own particular requirements by adding P. Q. #500 Concentrate to water to form a stable milky-white emulsion (not to be confused with soluble cutting oils). By adding more oil to water, longer periods of indoor rust protection can be obtained due to increased film thickness.

The material may also be added to conventional oils or solvents. It is applied by brushing, dipping or spraying. When blended, the material is

considerably more economical than conventional types of rust preventatives, it is claimed. Since it substitutes water for flammable solvents, this eliminates potential fire hazards.

77/Circle on Readers' Service Card

### Pressure Regulator

*Alemite Div., Stewart-Warner Corp., Dept. MF, 1826 Diversey Pkwy., Chicago 14, Ill.*

A new, highly sensitive low pressure (0-50 psi) material pressure regulator holds outlet pressure constant, without flutter, to pin-point adjustment regardless of the pressure in the main line.

Designed especially for paint circulating systems where control of paint pressures between the pump outlet and spray gun must be precise and constant for efficient application, the new regulator is unaffected by solvent action and abrasion and will handle any material with near normal pH. The new design eliminates restricting passages and the possibility of clogging while allowing easy cleaning by back flushing. A removable wrench-type adjusting key allows permanent pressure setting. The in-line regulator is equipped with a 60-pound gauge regulated so that the outlet pressure of 50 psi will be the maximum obtainable.



78/Circle on Readers' Service Card








79/Circle on Readers' Service Card



**STEEL FABRICATOR INCREASES PRODUCTION WITH SPEE-FLO PACKAGE UNIT**

**PROBLEM:** To finish an additional 15 tons of fabricated steel daily with no increase in facilities or personnel.

**SOLUTION:** Installation of Spee-Flo "Little Chief" Portable Hot Spray Unit.

The Offenhauser Company, Houston, fully expected to add to its spraying area and paint crew in order to finish ⅓ more products daily. However, with Spee-Flo Portable Paint Heaters, they handled the increased production *without adding to their overhead.* Overspray is greatly reduced, and they enjoy big savings in solvent and coating materials.

The same advantages and benefits result with any type of finish when it is hot sprayed. See what it can do for *you.*




WRITE for free booklet, "Why Hot Spray?"

SPEE-FLO

Dept. MF-35, 720 Polk Ave., Houston, Texas

7531

80/Circle on Readers' Service Card

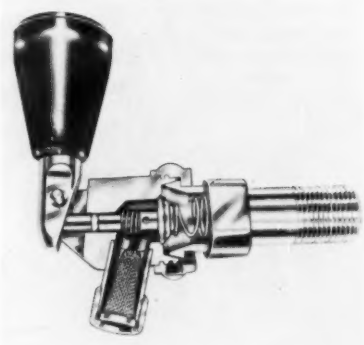
### Stainless Dispensing Faucet

*Eco Engineering Co., Dept. MF, 12 New York Ave., Newark 1, N. J.*

An improved corrosion-resistant faucet constructed of 303 stainless steel with Teflon O-ring seals is designed to dispense corrosive and flammable fluids. The unit has been approved by the Factory Mutual Engineering Division of Factory Mutual Laboratories.

The faucet provides both fluid and vapor-tight seals over a wide temperature range. Sealing is accomplished by internal system pressure which eliminates seizure problems that are prevalent in mechanically pre-loaded dispensing equipment.

The faucet is self-closing when not held open manually and the Teflon seals insure positive shut-off with no after drip. A guard prevents the unit from being jammed in the open position. It is now available in two sections so that the dispensing end may be removed for easy chemical or steam sterilization, while the shank remains as a permanent installation in the drum. A stainless steel screw cap with Teflon seal is available as optional equipment to seal the shank. With this two-piece assembly, the drum can be moved without danger of damaging the faucet. Shanks can be supplied with interchangeable sizes of ⅜", ¾" and ½" with tapered threads that afford a snug fit in the bung threads of drums.



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## NEW BOOKS

### Transactions Institute Metal Finishing

*Published by Institute of Metal Finishing, 32 Great Ormond St., London, W. C. 1. 1957. 495 pages, including index. Price: 3 Guineas to non-members.*

Volume 33 consists of the papers presented during the 1955-6 period and, as usual, contains a wealth of information on developments in metal finishing, ranging from the theoretical to the practical. Among the more valuable papers could be listed deposition of tin-cadmium and tin-zinc alloys, chemical polishing and anodizing aluminum, electroforming, organic finishes, electroless nickel, and hard chromium, all by some of the most eminent British investigators. The price of the volume is very reasonable considering the value of the data to the progressive finisher.

### Chemical Engineering Catalog

*Published by Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y. 1958. 1960 pages.*

The forty-second annual edition of this buyers' guide is now available without charge to users of engineering materials and equipment. The catalog is indexed by company name, functions, equipment and materials of construction, specialized services such as contracting, consulting and processing facilities, and trade names. It also includes a section in which are listed manufacturers prepared to turn out

small scale and laboratory equipment for pilot plant work.

As usual, this weighty volume continues to list the latest advances in chemical process industries and to serve as the leading source for information on products and services.

## BUSINESS ITEMS

### Stokes Appoints Goehring Manager of Mfg.



Walter W. Goehring

*Walter W. Goehring* has been appointed manager of the manufacturing department of *F. J. Stokes Corp.*, Philadelphia. He was formerly manager of manufacturing for the Can Division of Crown Cork & Seal Co., Inc., and before that was general factory manager of SKF Industries, Inc., a firm which he had served for twenty years.

A native of Philadelphia, Mr. Goehring was graduated in 1934 from Drexel Institute of Technology with a B.S. in Mechanical Engineering. He is a member of two honorary engineering fraternities, Pi Tau Sigma and Tau Beta Pi, and of the American Management Association.

### Glidden Co. Promotes LeRoy S. Fulton

Appointment of *LeRoy S. Fulton* as executive assistant to *A. D. Duncan*, vice president of *The Glidden Company* and general manager of the firm's paint division, was announced recently.

Mr. Fulton, a veteran of nearly 38 years in the paint industry, joined the firm in 1920 as an accountant. Successive positions include those of auditor of disbursements; auditor of retail stores; branch manager, Atlanta, Georgia; sales manager and regional director aof the St. Louis division; director of regional distribution and, most recently regional director of the Pacific Region, the post which he is vacating.

A native of Cleveland, Ohio, Mr. Fulton will be located at the company's headquarters offices there.

### Sole Chemical Appoints Representative

*Hukill Chem. Corp.* has been selected by *Sole Chem. Corp.*, Chicago surfactant producer, to serve as technical sales representative in Ohio, western Pennsylvania, and southern half of Michigan.

### New Development Center for Pittsburgh Plate Glass

A new development center will be constructed at Springdale, Pa., for the *Paint and Brush Division* of *Pittsburgh Plate Glass Co.*

Construction on the two-story structure containing more than 15,000 square feet of floor space will begin immediately. Estimated completion date is September 1958.

The development center will be used to develop processes capable of efficiently producing newly developed paint, plastic, and brush materials. Development work will be continued also


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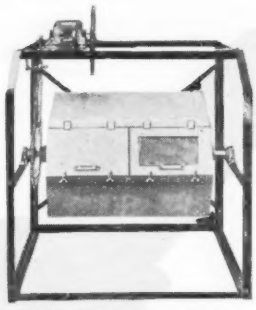
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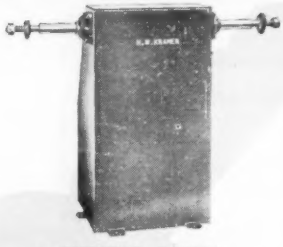
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on existing processes in an effort to attain more efficient and economical production of products now in commercial use.

Operation of the new center will be under the general supervision of *Paul R. Croll*, general manager of technology for the division.

### Shannon Appointed By Van Straaten Chemical Co.

*Thomas P. Shannon* of East Lansing, Mich., has been appointed sales and application engineer of the central Michigan territory of the *Van Straaten Chem. Co.*, Chicago manufacturers of cleaning compounds. Mr. Shannon, a mechanical engineer, and organizer of the first American Society of Lubrication Engineers chapter in Syracuse, N. Y., has moved from Syracuse to East Lansing.

He spent half of the last 16 years in engineering and production and half in sales and application of tool lubricants and coolants.

### Carboline Moves to New Quarters

In line with a general expansion program, *Carboline Co.*, manufacturers of corrosion resistant protective coatings and linings, announces the moving of their general office and research laboratory to a recently completed new building. The new address is No. 32 Hanley Industrial Center, St. Louis 17, Mo.

Almost triple the space of their old location, the new laboratory is modern in all respects. Among the innovations are an application research department with all the various types of industrial equipment now available for coating applications. Included are various types of hot spray, heavy body pump guns, airless spray equipment, and special high pressure spraying at pressures up to 150 pounds. A large section of the laboratory is devoted to the testing department. Here the evaluation of chemical resistance and physical properties of all types of coating materials is done.

### Formation of General Vacuum Corporation

*W. G. Overacker* of Winchester, Mass., has announced the formation of *General Vacuum Corp.*, of which he is president. The new company is located at 400 Border St., East Boston, Mass., a short distance from the airport and downtown Boston. The plant has 25,000 square feet of manufacturing and office space. Other officers of the new company are *R. A. Knight*, of Wenham, treasurer, and *D. J. Tobin*, of Wellesley Hills, vice president. The new company plans to concentrate its effort on engineering, development, testing and sales and that arrangements have been made for Artisan Metal Products, Inc., of Waltham, to fabricate equipment to General's design. The new company plans to concentrate initially on the intermediate sizes of special high vacuum equipment.

Mr. Overacker was formerly sales

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manager of NRC Equipment Corp. Mr. Tobin, who will head up the design and engineering group, was formerly in charge of engineering at NRC.

### Free Course in Electroplating

The course of study in electroplating given at the Fort Greene Evening High School, 29 Fort Greene Place, Brooklyn, N. Y., (formerly Brooklyn Evening Technical High School) will begin its Spring term on February 3, 1958.

The session is divided into classroom discussion and laboratory experiments. The classroom topics will include simple calculations, reading graphs, chemistry of the plating tank, pH, wetting agents, pitting, deionizing. The laboratory experiments will include solution analysis, Hull cell studies, anodizing.

Registration begins January 27, 1958, and daily thereafter from 7:00 to 9:00 P.M. Classes will meet on Monday and Wednesday from 6:45 to 8:15 P.M. including about six Fridays. The term begins February 3 and ends June 30, 1958. Register with *Mr. L. Serota* in Room BW17 or 3E10.

### Dow Names Larabee To Solvents Sales Post

Appointment of *Frank W. Larabee* as manager of the solvents section of a recently expanded chlor-alkali sales organization, headed by *Ken Wildes*, has been announced by *The Dow Chemical Co.* He will assume the duties of *L. P. Butenschoen*, who recently was transferred to a post in the traffic and distribution department.

Larabee has been a product manager in chlor-alkali sales since 1954. Prior to 1954, he was sales office coordinator on alkalies and chlorine. He also served as a calcium chloride and agricultural chemicals salesman in Wisconsin.

He attended Wabash College.

### Kaykor Appoints Wagner Bros. Division as Distributor

The Equipment Division of *Wagner Brothers, Inc.*, Detroit, has been appointed an area distributor of a complete line of corrosion-resistant lining materials manufactured by *Kaykor Industries, Inc.*, Yardville, N. J.

### DeVilbiss Makes Change of West Coast Sales Head

The transfer of *D. L. Bohon*, from his position as regional sales manager for the West Coast to the home office sales department in Toledo has been announced by the *DeVilbiss Co.*

He will be replaced by *George W. Fulton*, who becomes regional sales manager with headquarters at the direct factory branch in Los Angeles.

Mr. Bohon's transfer will become effective almost 18 years to the day from the date he joined the company as a salesman Dec. 1, 1939. He was named branch manager in Santa Clara in 1951 and made West Coast manager in 1953.

Mr. Fulton joined the company as a


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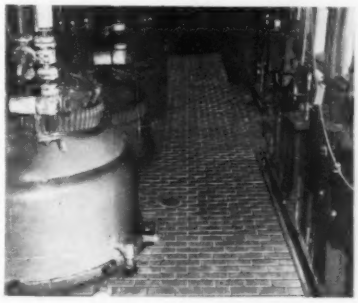
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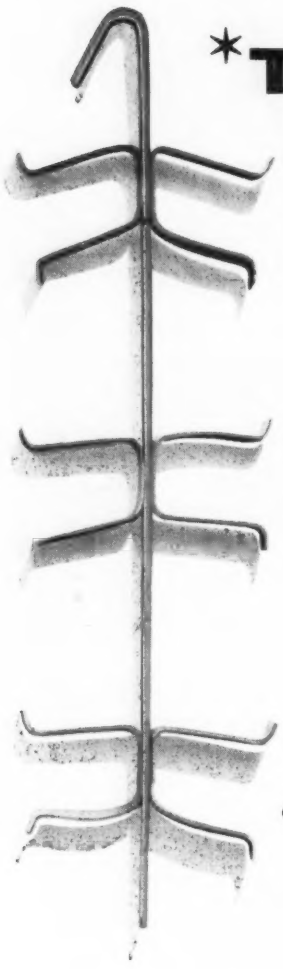
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salesman in 1946 and has been working for the sales department on the West Coast since.

### Dalic Opens Two More Offices in U. S.

*Dalic Metachemical, Ltd.*, of Toronto, Canada, has announced the opening of two new offices in the United States. The Western representatives, *Piddington & Associates, Ltd.*, 3219 East Foothill Blvd., Pasadena, Cal., are headed by *L. W. Pidington*, and service California, Nevada, and Arizona. *Ohio Metachemical, Inc.*, 2742 Second St., Cuyahoga Falls, Ohio, is the Midwestern office which handles sales and service for Ohio, Indiana, Kentucky, and Tennessee. This firm has retained *P. H. Brotzman*, well-known Ohio metallurgist, as administrative consultant.

### Handy & Harman Building Larger Pacific Coast Plant

*Handy & Harman*, world's largest fabricators and refiners of precious metals, is building a new and larger plant at 33 North Gibson Road, El Monte, Calif. The new plant, complete with office, laboratory, refinery, operating area and warehouse, will cover more than 23,000 square feet. It will have twice the capacity of the plant which the company opened in April 1947 at 3625 Medford St., Los Angeles.



As the company's fifth plant, it is scheduled to begin operating in February 1958. The Los Angeles plant then will close.

With the warehouse, the new plant will duplicate the operations and services of the plant at Bridgeport, Conn., which for years has served manufacturing jewelers and silversmiths and industrial customers. Also, it will comprise the most complete and extensive precious metal refining and fabricating facilities west of Chicago.

Upon completion of construction, the new plant will operate under the supervision of *H. A. Folgner* as manager. Mr. Folgner currently is manager of the Los Angeles plant.

### Walters New Manager of Stokes Canadian Subsidiary

*Fred Y. Walters, Jr.*, has been appointed manager of *F. J. Stokes Co. of Canada, Ltd.*, a subsidiary of *F. J. Stokes Corp.*, Philadelphia. Headquarters of the Canadian company are at 27 Wellington St., East Toronto.

Mr. Walters started with the Canadian firm as a sales engineer in January, 1955. A Canadian citizen and a long time resident of Toronto, he was graduated from McGill University in 1952 with a B. Eng. in mechanical engineering. While in college he was features editor of the college weekly, and was elected to Phi Epsilon Alpha, honorary engineering society. Before joining Stokes, he had been, successively, a sales applications engineer with Vickers, Inc.; a production and service engineer with Gutta Percha & Rubber, Ltd., moulders and extruders, Toronto; and a methods engineer with Northern Electric Co., Ltd., Montreal.

### Conforming Matrix Spray Painting and Decorating Technical Clinics

A series of technical clinics emphasizing spray decorating techniques and new developments in automatic spray painting machines will be held in five key cities during January, February

and March. *Conforming Matrix Corp.* is sponsoring the events, which will be held:

January 9 — Hotel Hollenden, Cleveland

January 23 — Hotel Van Cleve, Dayton

February 6 — Hotel Claypool, Indianapolis

February 27 — Hotel Biltmore, New York City

March 7 — Hotel Statler, Hartford, Conn.

There will be sessions at 10:00 in the morning and 2:00 in the afternoon. They will include industrial films which show the proper use of spray guns, the care and maintenance of spray equipment, advantages of metal masking techniques, and various types of automatic spray painting machines.

There will be a panel of trained engineers to answer questions and help solve problems in the spray decorating field. It will be comprised of specialists including *Hamilton E. MacArthur, Leo McHue, Charles Van Dusen, David Simmons, Joseph Kertz, A. M. McIntire* and *Gerald Minnick.*

Guest cards will be sent to those addressing the company at 349 Factories Bldg., Toledo 2, Ohio.

### American Buff Appoints Hulland

*American Buff Co.*, Chicago manufacturer of a wide line of buffs for the metal finishing industry, announces the expansion of its sales staff with the appointment of *Bob Hulland* as sales and service engineer for the Syracuse, N. Y. area. After four years active duty with the Marine Corps, he entered the die-casting industry as a die-cast operator and then became a tool and die maker. After serving as journeyman tool and die maker, he spent two years as chief inspector with Precision Casting Co., Chicago. Since 1954 he has served as plant superintendent for Univex Die Cast and Engineering Co. of Dearborn, Mich., where he lives with his wife and four children.



Bob Hulland

### Campbell Joins H. N. Hartwell & Son, Inc.

*H. N. Hartwell & Son, Inc.*, Boston, Mass., distributor of rigid polyvinyl chloride, announces that *Charles V. Campbell* has joined its Industrial Plastic Division as division engineer. Mr. Campbell was formerly with the Atomic Energy Commission's Raw Material Laboratory in Winchester, Mass.

### Ross Engineering Appoints Jean F. Gschwind

*J. O. Ross Engineering Corp.*, New York, N. Y. announces the appointment of *Jean F. Gschwind* as vice president of development and research, a new office in the company. He will be in charge of all development and research activities concerning the firm's air processing systems.

Mr. Gschwind has been with the company for more than 20 years, his most recent post being vice president and general manager of the Ross Midwest Fulton Corp. in Dayton. Other positions held include head of the development laboratory and manager of





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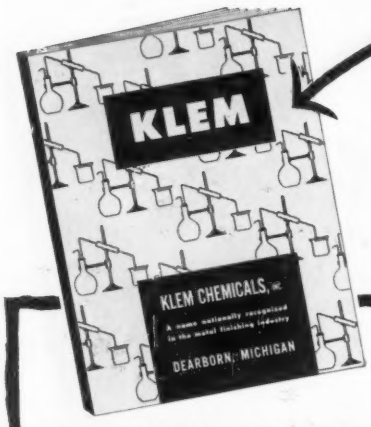
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Jean F. Gschwind

the Supertherm Department.

Mr. Gschwind received his technical training at the Swiss Federal Polytechnicum in Zurich, Switzerland and is a licensed Professional Engineer in the State of New York. He is succeeded at Ross Midwest Fulton by *Robert M. Cook*.

### Peninsular Metal Products Acquires George L. Nankervis Co.

*Peninsular Metal Products Corp.*, of Ferndale, Mich., has announced it has entered into an agreement to acquire all of the outstanding stock of the *George L. Nankervis Co.*, of Detroit, prominent supplier and engineers of metal finishing equipment. Nankervis, when acquired, will be operated as a wholly owned but independent subsidiary, and the personnel and policies will not be affected by the change of ownership.

*George L. Nankervis*, founder of the company, died early last year. The majority of the stock in the company was owned by him.

### Industrial Systems Appoints Gilbert

*Industrial Systems Co.* announces the appointment of *Donald A. Gilbert* of the *Production Heating Equipment Co.*, 13231 Euclid Ave., Cleveland 12, Ohio, as representative for the State of Ohio, for their line of metal cleaning and processing machinery, paint bake ovens and spray booths.

### New Consulting Firm

*A. L. Pietrowicz* and *John E. Manning* announce the formation of their consulting firm, *Scientific Control Laboratories of California*, with laboratory and office facilities at 1700 E. Gage Ave., Los Angeles 1, Calif., telephone LUdlow 2-3794.

"Boots" Pietrowicz went into the job plating business in Chicago after his graduation from the University of Alabama and eventually became sole distributor on the west coast for Promat, before entering the consulting line.

Mr. Manning, a graduate chemical engineer from Michigan State, who is considered one of the outstanding experts on anodizing and treatments for light metals, was chief chemist and process engineer for Anadite, Inc. before joining Mr. Pietrowicz.

### MacDermid, Inc. Appoints Lowe

*Clyde Lowe* has been named Cleveland representative of *MacDermid Inc.*,



Clyde Lowe

Waterbury, Conn. manufacturer of metal cleaning, plating and finishing chemicals. Since 1940, he has been associated with Cowles Chemical Co., manufacturers of industrial, dairy and metal finishing chemicals. Prior to 1940, he held a wide variety of positions in the metal finishing industry.

He is now located in the Cleveland area and will work closely with MacDermid distributor salesmen in Ohio and Western Pennsylvania.

### Union Carbide Appoints Division Vice-President

The appointment of *K. H. Rowland* as vice-president — production of *Union Carbide Chemicals Co.*, division of *Union Carbide Corp.*, was announced recently.

Mr. Rowland, who joined the corporation in 1934 as an engineer in the South Charleston plant of the chemicals company, has been the company's works manager. He attended the University of Richmond and the University of Michigan, receiving the degree of B.S. Ch. E. in 1934 from the latter institution.

### Stanley Chemical Appoints Rental

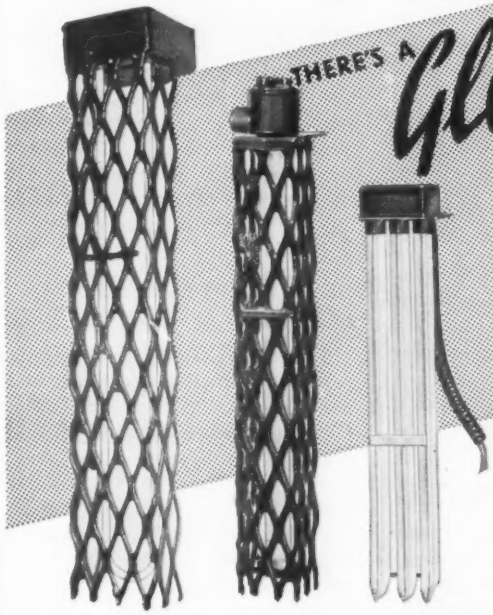
*Chester F. Rental* has joined *The Stanley Chemical Co.*, East Berlin, Conn., a subsidiary of The Stanley Works, as technical service supervisor. He will report directly to *Valentine B. Chamberlain, Jr.*, sales manager of the subsidiary.

Mr. Rental was previously employed by the firm in the laboratories and, prior to this, he was an industrial sales representative for Benjamin Moore and Co. of New York City. In his new capacity, he will be responsible for customer field service.



Chester F. Rental


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Born in Dickson City, Pa., and educated in New Britain, he entered the U. S. Army in 1942. Following overseas duty, he was discharged in 1945 with the rank of Warrant Officer.

### Alan Baker in New Location

*Alan Baker Co.*, manufacturer and distributor of electroplating and polishing equipment and supplies, has moved to new quarters at 180 Sylvester Road, South San Francisco, Calif. The telephone number is Plaza 5-6506.

### Northwest Chemical Names Special Representative

*Northwest Chemical Co.* of Detroit announces the appointment of *Rex MacKercher* as special representative



Rex MacKercher

on product application. He will work closely with customers in supplying information on products and methods developed in the company's laboratories. In this assignment he will supplement the established sales force.

Mr. MacKercher's academic training and broad industrial experience especially equip him to render this highly technical service to the metal finishing industry. In addition to a degree in chemical engineering, he has extensive experience in the field of industrial cleaning and metal finishing. His background includes technical sales, production and development experience with some of the country's largest chemical firms.

He is a member of the American Electroplaters' Society and American Chemical Society.

### New Sales Engineer for Branson

*Branson Ultrasonic Corp.*, Stamford, Conn., manufacturer of ultrasonic cleaning and testing equipment, has appointed *Mordy M. Rhodes* as sales engineer for the midwestern area. Located at 5027 N. Harding Ave., Chicago 25, Ill., Mr. Rhodes' office will cover Northern Illinois and all of Iowa, Minnesota, and Wisconsin.

An electrical engineering graduate from the Illinois Institute of Technology, Mr. Rhodes has spent his last six years as a midwest instrument representative, specializing in ultrasonics since 1954. He is a member of the Society for Nondestructive Testing and the American Electroplaters' Society.

### Green Elected Vice-President of National Research

The election of *Frederick H. Greene, Jr.* to the position of vice president has been announced by *National Research Corp.* He joined the firm in 1955 and has served as director of the Commercial Development Department for the past year and a half. Before joining the company, Mr. Greene was associated with the Corning Glass Works and, more recently, with the Division of Industrial Cooperation at M. I. T.

A native of Massachusetts, Mr. Greene received his Bachelor of Arts degree from Brown University and served as a captain in the United States Air Force in China during World War II. He lives in Lincoln, Mass.



Frederick H. Greene, Jr.

### Michigan Chrome Appoints Neeme

*Michigan Chrome and Chemical Co.*


**BEAM-KNODEL CO.**

Metropolitan Distributors

HANSON-VAN WINKLE-MUNNING CO.

Complete Service for Metal Finishing

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195 LAFAYETTE ST., COR. BROOME

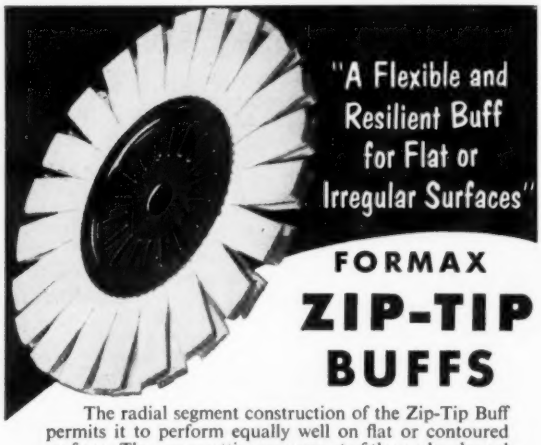
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LEA Buffing & Polishing PRODUCTS

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**ZIP-TIP BUFFS**

The radial segment construction of the Zip-Tip Buff permits it to perform equally well on flat or contoured surfaces. The cross-cutting movement of the spoke-shaped segments prevent work streaking while it breaks up straight-line patterns on the surface.

- Zip-Tips are available in a wide variety of all cloth constructions —also combinations of cloth and sisal.
- Zip-Tips are made of heavy-duty, bias-cut materials mounted on ventilated steel centers.
- Zip-Tips are extra thick and provide wider buff faces with greater compound retention capacity.
- Zip-Tips are perfectly balanced —require no raking.

*Write for Descriptive Literature*

**FORMAX MFG. CORP.**

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"THE FOUR McALEERS"

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Al Neeme

announces the appointment of *Al Neeme* as West Coast sales representative. He served for a number of years as sales engineer in the Plating Division of the company and for two years was assistant manager of the division.

Neeme will be responsible for sales on the West Coast, and has established headquarters in the Los Angeles area.

## Manufacturers' Literature

### Power Rectifiers

*Allis-Chalmers*

The above firm has issued a four page, illustrated bulletin on its germanium, silicon and selenium rectifier units, which are particularly applicable in the electrochemical industries. A chart shows the approximate direct current and voltage ratings most economical for the various types of rectifiers.

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### Corrosion Preventives

*Pennsylvania Refining Co.*

A chart of military-specification corrosion preventives for industrial and military use, presents data on 20 corrosion preventives, including solvent cutbacks, petrolatum barriers, general purpose preservatives and engine preservation lubricants.

Information shown includes physical properties, application, removal, coverage and uses. Data also are given on methods of cleaning and preservation.

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### Plastic Gate Valve

*Vanton Pump & Equipment Corp.*

A four-page booklet contains all the essential and usable data about a new and unique Flex-Plug all-plastic gate valve for conveying corrosive and abrasive liquids in lines that must be chemically free of contamination.

Details about the new valve are spelled out in this new booklet, which includes simplified drawings showing the advantages.

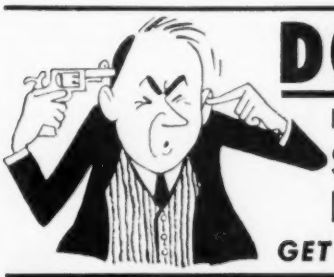
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### Hard Anodizing-Precision Plating

*Anachrome Corp.*

A new 20-page brochure entitled, "Precious Finishes on Metals" places particular emphasis on the Hardas process of hard anodizing.

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DON'T LET YOUR STRIPPING PROBLEMS GET YOU DOWN!

EPOXYSTRIP

Is a LIFE SAVER—TIME SAVER—MONEY SAVER

A new more powerful paint stripper that outstrips all others! No organic finishes have yet resisted this amazing paint stripper. It was especially formulated to remove epoxies . . . with the same ease that it removes baked enamels, lacquers, etc. No stripping scum—clean rinsing!

- EPOXYSTRIP WILL NOT HARM SOFT METALS
- ECONOMICAL—MORE JOBS PER GALLON AT LOWER COST
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- RECOMMENDED BY LEADING FINISH MANUFACTURERS

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A COMPLETE LINE OF . . .

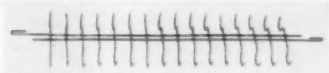
PPI PLATING RACKS



No. 16-SS uncoated 95c Each



No. 12-SS uncoated 95c Each



No. 32-SS uncoated 95c Each



No. 58-AR Anodizing Rack $2.50 Ea.

Standard Splines (above) . . .
Made of steel with spot welded cross wires—Horizontal 18 in. width or vertical 24 in. length to fit standard frames — 1, 1½ or 2 in. hook spacings.

Anodizing Racks . . . . . .
All aluminum — 48½ in. length. Ideal for handling small parts — Prongs can easily be bent to hold various sizes and shapes.

*Special Racks Built to Your Specifications*

*Dependable PPI Products . . .*
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1509 N. WASHINGTON
KOKOMO, INDIANA

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### Filtration Equipment

*Commercial Filters Corp.*

A new catalog has just been published on Fulflo and CFC filtration equipment. The catalog describes and illustrates each type of filter.

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### Graphite Heat Exchangers

*Falls Industries, Inc.*

The latest data on standards and optional designs of Impervite brand impervious graphite tube and shell heat exchangers are covered in a new technical Bulletin No. 448. Included are amounts of effective transfer surface for both open and closed tube pitch spacing up to 2300 square feet, a brief presentation of the characteristics of impervious graphite, as well as the temperature and pressure limitations of the material in the tube and shell design, a tabulation of dimensions of the standard exchangers, a semi-detailed discussion of the standard but optional designs available, such as tube size and pitch, shell material, baffles, pass construction and nozzle placement.

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### Detergents

*Atlas Powder Co.*

A comprehensive yet compact list of the chemical and physical properties of Renex detergents is aimed to help formulators easily compare and select the proper detergents for specific uses. Fourteen liquid and solid nonionic detergents are listed in chart form according to their physical characteristics: hydrophilic-lipophilic values, solubility in various solvents, foaming, cloud point, etc. Outlined suggestions for application are enumerated on another chart.

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(*Continued on page* 115)

## OBITUARIES

### RICHARD O. HULL

*Richard O. Hull*, founder and president of the *R. O. Hull & Co., Inc.*, was stricken suddenly with coronary thrombosis and succumbed at Lakewood Hospital, Friday night, November 29th. He was 52 years of age.

One of the world's authorities on electroplating, Mr. Hull had more than 30 patents to his credit pertaining to the plating and testing of tin, copper, zinc, cadmium, and other metals — of which most continue in use today. His invention of the Hull Cell gained him world-wide recognition through its use as the standard control and evaluation method for plating baths.

Mr. Hull was born in Troy, N. Y. He led his class at the University of Colorado and graduated with special honors. While doing graduate work at George Washington University in Washington, he worked for the Bureau of Standards under *Dr. William Blum*. He became an authority on the deposition of copper while with RCA Victor in Camden, N. J.

Mr. Hull joined Dupont in 1933 and became assistant research director of the Electrochemical Department before leaving to found his own firm in 1944.

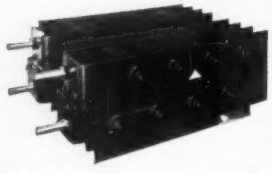
In the past, Mr. Hull supported a number of philanthropic activities including the Engineering Development

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★ Operate from —40° to 225° F.
★ 50 to 50,000 Amperes DC
★ Built-in Voltage Regulator and Meters
★ Heavy Duty Transformers, Husky Fans

Two styles available—1. Selenium for cool zones, or 2. Magnesium copper sulphide for the hot, dirty jobs. Units still running after 4 years of constant duty.





Replacement Rectifier Stacks for Lektron or Udylite-Mallory

Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs.

Model 4045—750 amps at 12 volts DC—1500 amps. at 6 volts D.C. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

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- ROLLED ELECTROLYTIC PHOSPHORIZED COPPER ANODES
- CAST ELECTROLYTIC COPPER ANODES — All Shapes
- ROLLED TIN-LEAD ANODES
- CAST WHITE BRASS ANODES

Virgin Metals Used Exclusively

- ZINC ANODES
- TIN ANODES




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Fund for aid to students in the field of chemical engineering or for chemical research at the University of Colorado. He belonged to the American Electroplaters' Society, Institute of Metal Finishing, Electrochemical Society, American Chemical Society, American Institute of Chemical Engineers, Alpha Chi Sigma and Tau Beta Pi, a national honorary engineering society.

Mr. Hull is survived by his wife, the former *Ann Gregorie FitzSimons;* two sons, *Richard Jr.* and *Harry F.;* a daughter, *Mrs. Robert C. Platt;* six grandchildren; his mother, *Mrs. M. M. Hull;* a sister, *Mrs. D. H. Faires,* and a brother, *William L. Hull.*

### HENRY J. KINGSBURY

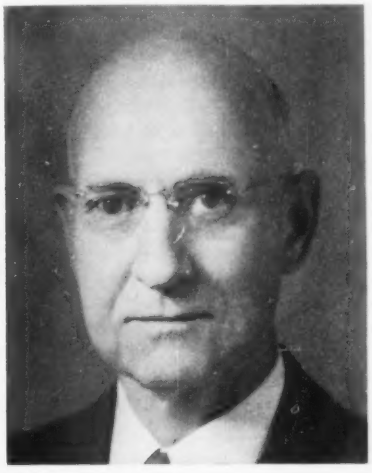
*Henry J. Kingsbury,* 74, former chief engineer of *Hammond Machinery Builders, Inc.,* died October 18. He had been associated with the firm for over fifty years.

### T. V. DuBOIS

*T. V. DuBois,* founder and president of the *DuBois Co., Inc.,* Cincinnati, manufacturers of chemical cleaning compounds, died suddenly of a heart condition, at his home, on Nov. 23.

DuBois founded the company in 1920.








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DEPTH FILTRATION




provides many successive filtrations in ONE operation — clear and continuous through multi-layered SETHCO filter tubes. Removes all course and fine particles down to one micron. Fast, effective filtration and recovery of all electroplating and industrial solutions — hot, cold, alkaline or acid from pH 0 to pH 14. Compact, portable — simple operation and care . . . at low cost.

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★ 48 Positive Contacts Designed for "Speedy" Racking

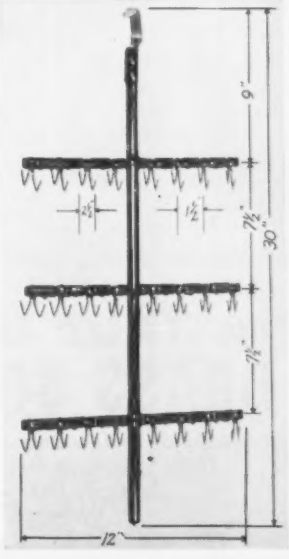
★ .090 Phosphor Bronze Spring Wire

★ Plastisol 100% Solids Insulation

$6.50 EACH



F.O.B. Skokie, Illinois




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## News from California

By Fred A. Herr



Members of Los Angeles Branch, had an opportunity to return some of the fine hospitality which was extended to *Mr. and Mrs. Don Bedwell* on their visit to Australia in July, 1957, to two visitors from down under who stopped off in Southern California in mid-November.

In Los Angeles for a 3-day visit were *Mr. and Mrs. Eugene Wright* of Sydney. Mr. Wright was one of the earliest Australian members of Los Angeles Branch in the days before A.E.S. branches were set up in Sydney, Melbourne and Adelaide. He served as first secretary of the Sydney branch and had been in contact with various Los Angeles members by mail for many years.

Mr. Wright, now retired, formerly served as plating shop supervisor for the General Electric Co.'s Hotpoint plant in Sydney. He and his wife stopped off in Los Angeles after returning to New York from a European tour. They arranged to get a good look at the American West by riding the bus from Albuquerque, N. M. to Los Angeles.

Mr. Bedwell and *Earl Coffin* escorted the Wright's on visits to several of the larger job shops in Southern California, including Modern Plating Co. and Cadmium & Nickel Plating Co.

---

A new electrolytic tin plating line to supplement the original 100-foot completely automatic cleaning, pickling, and plating line installed for sheets in 1953-54, is included among the production facilities to be added to the Kaiser Steel Corp. plant in Fontana, Calif., as part of a $194,000,000 expansion program announced on December 1. The new tin plating line will, in its essentials, be similar to the original line in which 5,000 foot rolls of sheet steel, eventually intended for West Coast canneries and other users of tin cans, are sent through a series of tanks

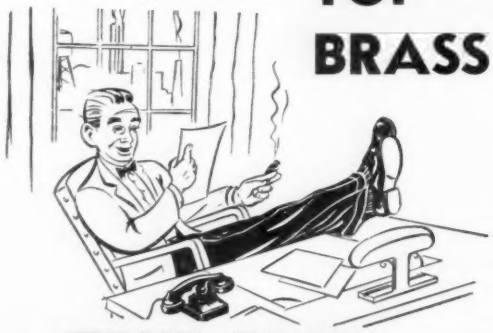
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*Robert F. Kelleher,* formerly an abrasive engineer in the Detroit area for Bay State Abrasive Products Co. of Westboro, Mass., now of Whittier, Calif., has been transferred to the West Coast branch office to serve in a sales engineering capacity.

---

*Morris Chaikin* rescently was appointed West Coast sales manager for Chase Buff Co. of New York. Los Angeles warehouse and offices are at 3757 Wilshire Blvd. Chaikin declared that he had been hoping to return to California ever since he completed his preflight training as an air cadet at Santa Ana Airbase, 40 miles south of Los Angeles, in 1944.


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USE **TRUE BRITE BRASS SOLUTIONS**

Trouble Free — Low Cost
Little Supervision Needed
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**PAINT REJECTS**
WITH
**PHOENIX COLD STRIP**

- QUICK REMOVAL OF ALL PAINT TYPES . . . INCLUDING EPOXIES
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***FREE LABORATORY SERVICE***
**FOR YOUR STRIPPING PROBLEM.**

Send sample of your stripping problem for prompt FREE analysis and recommendation.

**LET US SOLVE YOUR PAINT STRIP PROBLEMS**

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657 BERRIMAN ST., Brooklyn 8, N. Y. • Nightingale 9-2771

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Simonds Abrasive Co. of Philadelphia, Pa. announces completion of a new manufacturing plant in El Monte, Calif., for the production of grinding wheels, other bonded abrasive products and abrasive grain. The plant is reported to be fully equipped for production of vitrified and resin bonded abrasive items, the plant is equipped to provide service for altering and working on grinding wheels, as well as containing warehouse space for finished materials. The new El Monte facility supplements branch warehouses previously established in San Francisco, Calif., and Portland, Ore.

---

*John E. Mungenast* of Lynchburg, Va., an engineer with the General Electric Co.'s rectifier division, made a flying trip to the West Coast in November to address Far West Branches of the A.E.S. He appeared before Los Angeles Branch on November 14 and subsequently as guest speaker on germanium ond silicon rectifier subjects before San Francisco, Portland, Seattle and Vancouver, B. C. branches.

John turned out to be the son of an old St. Louis friend, *Andy Mungenast*, with whom this writer was associated in 1919-1920 as a charter member in the founding of the National Junior Chamber of Commerce. In the summer of 1920 Andy Mungenast, then secretary of St. Louis Junior Chamber of Commerce, inspired the calling of a caucus in St. Louis out of which developed the National Junior Chamber of Commerce, which now has chapters in a hundred or more American cities.

---

Scientific Control Laboratories of California was established in Los Angeles recently to provide consulting service to plating shop operators and to engage in research on electroplating and electrochemical problems.

Associated in the enterprise are *A. L. "Boots" Pietrowicz*, recently a sales engineer for Sundmark Supply Co. of Los Angeles, and well known in the middle west as the former operator of the Driscoll Plating Co. in Chicago; and *John E. Manning*, formerly chief chemist for Anadyte, Inc., South Gate, Calif. They have remodeled the former quarters of Sundmark Supply Co. at 1700 Gage Ave., Los Angeles, into a laboratory for making salt spray, solution and other types of tests, and to engage in research on plating problems.

---

Houghton Laboroties, West Olean, N. Y., has named *Russell A. Skiff* as assistant sales manager of the west coast office. He will serve under west coast sales manager *Lloyd M. Dixon*, with headquarters at 5920 Smiley Drive, Culver City, a Los Angeles suburb.

---

Handy & Harman of New York, fabricators and refiners of precious metals, has construction underway on a new plant at 33 North Gibson Road, El Monte, Calif., into which the firm expects to move its West Coast facilities from 3625 Medford St., Los Angeles, around the middle of February, 1958.

The new plant is designed to con-





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tain 23,000 square feet of floor area allocated to offices, laboratory, refining and production areas and warehouse space. This will represent double the capacity of the Medford St. plant which the company opened in April, 1957, and which has already been outgrown.

*H. A. Folgner*, present manager of the Los Angeles plant, has been designated as manager of the new operations in El Monte, which is 15 miles northeast of downtown Los Angeles.

## Associations and Societies

### AMERICAN ELECTROPLATERS' SOCIETY

In connection with making your plans for attending the 45th Annual Convention of the American Electroplaters' Society, to be held at the Sheraton-Gibson Hotel in Cincinnati, Ohio, May 19-22, 1958, we are pleased to publish this information on transportation furnished us by the Convention Committee.

AIRLINES: The Greater Cincinnati Airport is serviced by five major airlines:

American Airlines
Delta Airlines
Trans World Airlines
Piedmont Airlines
Lake Central Airlines

Typical fares to Cincinnati are as follows:

| To Cincinnati from | Round Trip First Class (incl. tax) | Round Trip Air Coach (inc. tax) |
|---|---|---|
| Boston | $ 97.13 | $ 82.94 |
| Chicago | 37.00 | 24.20 |
| Cleveland | 31.35 | ..... |
| Detroit | 33.55 | ..... |
| Los Angeles | 258.94 | 191.40 |
| New York | 78.10 | 62.26 |
| Philadelphia | 71.17 | 56.76 |
| Pittsburgh | 39.16 | 31.46 |
| St. Louis | 43.78 | 35.20 |
| Washington, D. C. | 55.44 | 52.14 |

RAILROADS: Cincinnati's Union Terminal is the home for seven major railroads:

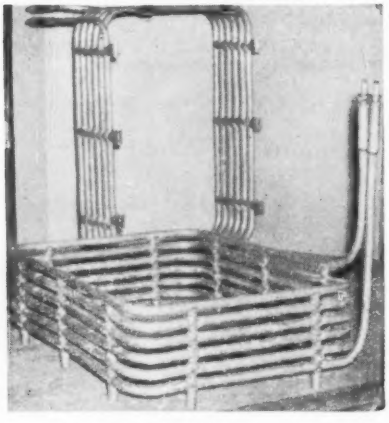
New York Central
Pennsylvania
Baltimore & Ohio
Louisville & Nashville
Chesapeake & Ohio
Southern
Norfolk & Western

Typical fares to Cincinnati are as follows:

| To Cincinnati From | Round Trip First Class (incl. tax) | One-way Lower Berth (incl. tax) |
|---|---|---|
| Boston | $111.27 | $ 15.84 |
| Chicago | 36.47 | 8.91 |
| Cleveland | 31.57 | 8.91 |
| Detroit | 31.57 | 8.91 |
| Los Angeles | 174.57 | 26.62 |
| New York | 88.39 | 13.42 |
| Philadelphia | 77.72 | 9.57 |
| Pittsburgh | 37.79 | 8.91 |
| St. Louis | 42.24 | 6.38 |
| Washington D.C. | 57.57 | 7.37 |

AUTOMOBILE: Cincinnati is favorably located for the trip by auto. A radius of 500 miles encompasses most of the electroplating centers in the


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Nickel Sulphate, Nickel Chloride Imported, Nickel Carbonate, Nickel Acetate, Potassium Cyanide, Copper Cyanide, Zinc Cyanide, Sodium Cyanide Eggs, Cobalt Sulphate, Cadmium Oxide, Trichlorethylene—Stabilized, Perchlorethylene, Caustic Soda, Caustic Potash, All Acids, Zinc Salts No. 1, reasonable.

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country. Many of these can utilize the modern expressways for a part or most of the distance.

The highway picture changes too rapidly to suggest routes. Some of the mileage figures may be of interest, and we list these as follows:

| To Cincinnati From | Distance Miles (AAA) | Driving Time (AAA) |
|---|---|---|
| Boston | 857 | 25 hrs. 35 min. |
| Chicago | 297 | 8 hrs. 20 min. |
| Cleveland | 244 | 7 hrs. 10 min. |
| Detroit | 254 | 6 hrs. 55 min. |
| New York | 673 | 19 hrs. 40 min. |
| Philadelphia | 585 | 16 hrs. 40 min. |
| Pittsburgh | 287 | 7 hrs. 55 min. |
| St. Louis | 341 | 8 hrs. 30 min. |
| Wash. D.C. | 489 | 13 hrs. 15 min. |

### New York Branch

The New York Branch of the American Electroplaters' Society will hold its Annual Educational Session and Banquet February 1, 1958 in the Penn Top of the Hotel Statler at 8:00 p.m. The Technical Session will be held in the afternoon at 2:30 p.m.

### Chicago Branch

The Annual Education Session and Banquet will be held on Saturday, January 25, 1958, at the Conrad Hilton Hotel.

Three papers will be presented at the technical session: "Deep Etching", by *Dr. Neal Berts* of The Diversey Corp.; "The Importance of Finishing and Packaging in Selling", by *Dr. Burleigh B. Gardner* of Social Research, Inc.; and "H.A.E. Process for Treatment of Magnesium", by *Dr. Harry Evangelides* of the Frankfort Arsenal.

### St. Joseph Valley Branch

The first meeting of the 1957-58 season was opened with a round robin of introductions. President *Art Wiegand* presented the new officers elected at the May Meeting. 2nd Vice President *Duke Wysong* was absent because of his required presence in Indianapolis with respect to plans for the January Interim Meeting. Applications of six prospective members were read. President Wiegand announced that the branch had won the previous year's membership award and urged those present to do their utmost in an effort to repeat. Vice President *Ray Dearth*, membership chairman, advanced the idea that each member attempt to bring in one new member.

Delegates to the 1958 Convention in Cincinnati were chosen and include: *Duke Wysong*, *Gene Roth* and *Henry Meers*. Alternates are to be: *Ray Dearth*, *Harold Wiesner* and *Ralph Brouwer*. Dr. Wiesner spoke on the possibility of the branch sponsoring further electroplating courses and urged prompt response to the question on reservation cards. The educational committee selected included Drs. Wiesner, and *Ernest Wilhelm*, *Duke Wysong*, *Ralph Brouwer*, *A. B. Matern*, *Wm. McDowell* and *Lou Ragne*.

A welcome visitor was *Paul Glab*, secretary of the Chicago Branch, who gave particulars concerning the 1962 Midwest Regional Convention. The latter is to be a joint effort of smaller surrounding branches in cooperation with the Chicago Branch. He asked for the appointment of delegates to attend an organizational meeting to aid


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in the planning and formation of the 1962 convention.

After a glowing report of the Montreal Convention by President Wiegand, the meeting was turned over to *Gene Roth*, past president, who introduced *Ezra Blount*, editor of *Products Finishing*, who showed both slides and movies on Japan to clarify and point up his subject matter to good advantage. The evening as a whole was very enjoyable and extremely informative. A rising vote of thanks was accorded Mr. Blount at the conclusion of his talk.

*Henry A. Meers*
Secretary-Treasurer

**Indianapolis Branch**

On November 6th, forty members and guests attended the regular meeting at Fox's Steak House. *Bert Hawhee* called the meeting to order and led the introductions. *Paul Johnson* of Guide Lamp Co. was commended for bringing the most prospective members.

*Dr. A. Max* advised that not enough applicants for the electroplating class would delay until January any availability of this educational study.

The following six applicants, all from Guide Lamp were elected to membership: *Maurice L. Grantham, Wendell K. Hall, Jack F. Hensley, Norman V. Peters, Richard N. Snyder,* and *Kenneth L. Turpin.*

One other application for membership with the proper requirements was received from *Walter J. Koswiscz.*

*Quentin Shockley* received a reply from the chairman of the Scientific Achievement Award Committee, accepting the names of Dr. Max and *Thomas Evans* as candidates from this branch.

*Edna Rohrabaugh, Addison Howard,* and *Les Reynolds* were appointed to a committee to make arrangements for Ladies Night in March '58.

Librarian *Addison Howard* announced that *Ed Bruck* would moderate in a round table discussion. Mr. Bruck chose Dr. Max, Mr. Shockley, and *Elmer Lundberg* as panel aides. Their answers helped to supply specific points to watch for in handling individual problems. Before anyone realized it, it was 10:12 P.M., at which time the meeting adjourned.

*Paul Freeman*
Secretary

**Los Angeles Branch**

Chairmen for all major convention committees for the 1960 A.E.S. convention in Los Angeles were announced at the November 13 meeting of Los Angeles Branch, by General Chairman *Tony Stabile* and Co-Chairman *George Hetz.*

The chairmen of the various committees are as follows:

Educational, *Earl Arnold;* Banquet, *Harold Smallman;* Entertainment, *Lawrence O'Neil;* Hotels, *Lawrence Henderson;* Housing, *Marty Barsoon;* Finance, *Walter Behlendorf;* Ladies, *Mrs. Glenn Beckwith;* Transportation, *E. Truman Stoner;* Plant Visitations, *Harvey Hunt;* Program, *John Millhorn;* Publicity, *Ed Wells;* Printing, *Stuart Krentel;* liaison with Metal Finishers Suppliers Association, *Herman Struckhoff.*

Mr. Hetz reported progress being


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made along all fronts of the convention planning for 1960 on which action can be taken at this time. Several meetings between the branch's officers and directors and the general chairmen were held during recent weeks and another is scheduled for early in 1958.

Five new members were inducted at the November meeting—*Andrew Nosting, Tom Brewer, Don Johnson, Joseph Lampher* and *R. B. Platt.* Among the guests introduced were *D. Davis* of L'Hommedieu, and *Alex Alexander* of Hanson-Van Winkle-Munning Co.

The scheduled talk on germanium and silicon rectifiers drew a considerable number of members and guests from Southern California rectifier manufacturing firms. These included *D. E. Cooper, W. C. Weld* and *C. J. Vickery* of International Rectifier Corp., El Eegundo, Calif.; *Keith Holtzclaw* of Perkins Engineering Co., El Segundo, and *Jack Bealle* of Crown Chemical and Engineering Co., Los Angeles.

Educational Chairman *Frank Virgil* had arranged for the appearance of an outstanding authority in the rectifier field to address this meeting in the person of *John E. Mungenast,* engineer for the Measurements and Industrial Products Division, Rectifier Department, General Electric Co., Lynchburg, Va. His talk dealt with progress that has been made in the last six years and experiments that are still underway for perfection of germanium and silicon rectifiers for plating shop as well as for other industrial purposes.

Mungenast has had extensive experience in the engineering, fabrication, servicing, and installation ends of the rectifier business and gave Los Angeles members an instructive review of the entire subject. His comment was amplified by a Cinerama type color film which showed germanium rectifier installations in the East, South and on the West Coast, and also offered explanatory details in connection with rectifier drawings and blueprints and cut-out designs which were projected on the screen.

### Newark Branch

The November 15 meeting of the Newark Branch was attended by about 90 members and guests. Two applications were received, and four applicants approved by the board of managers were elected to membership: *Helen Maroney,* Alymaco; *Clyde Rust,* Kelite Corp.; *Carl Rutgers,* B and S Engraving Co.; *Stephen Stross,* Turco Products, Inc.

President *Wm. Grigat* commended the Educational and Banquet Committee on the activity thus far in the year—4 meetings planning Branch activities having already been held. Bill also appointed *Helen Maroney* as official Newark Branch "Greeter" to assist Sergeant-at-Arms *John Banta* welcoming members and guests at each meeting.

*Dodd Carr* reported on the Banquet plans for December and *Cy LaManna* on the Electroplating School planned early in 1958, stating that registrations must be gotten in promptly.

Fred Meyer reported the meeting evaluation sheets distributed and returned at the September meeting indicated satisfaction with the program and he asked for suggestions at any


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time as to how the programs can be improved. Under Good and Welfare, Secretary Foulke reported with regret the passing of *Mrs. Tom Trumbour*, mother of Newark member *John Trumbour* and wife of A.E.S. Honorary Member, *Thomas Trumbour*.

Librarian Meyer introduced *Paul Theusen* of Metal Processing Co. who talked on "Electroless Nickel", discussing the properties of this type of deposit and describing applications for this plating technique. A number of colored slides described applications now employed.

*Stanley Rich* of General Ultrasonics was then introduced as the main speaker of the evening. He lucidly described the theory of ultrasonics, the equipment available and the applications for which the technique is particularly useful. After an extended question-and-answer period, both speakers were given a rising vote of thanks for their excellent contributions.

*D. Gardner Foulke*
Secretary

**Waterbury Branch**

The Waterbury Branch held their regular monthly meeting Thursday, November 14th at the Roger Smith Hotel. The attendance at the dinner and also at the meeting was the largest of the season. *Spencer Henn* of the Lea Mfg. Co. presided. He introduced *Harry Robins* of the Lawrence Smith Co., Sydney, Australia, who is visiting this country. Mr. Henn also introduced two new members: *David Stango*, Fabricated Metal Goods Division of the American Brass Co., and *Charles M. Nininger*, Oakville Co. Division, Scovill Mfg.

The meeting was then turned over to Technical Chairman *George O. Jabs*. The Educational Program started with the showing of a movie of the "Shepaug Dam." This was very interesting, as it showed the progress of construction from the beginning to the end.

The speaker was *Rene Sonnenfeldt*, sales engineer, Sel-Rex Corp. His subject was "Precious Metal Plating in Modern Industry Today", and also the "Status of Electro-Plating in Europe." Although Mr. Sonnenfeldt has been in this country for only two and one half years he made himself very well understood and quite an interesting speaker.

*Isidore Cross*, librarian, discussed plans for the "Sustaining Members' Night" to be held February 14, 1958. *Louis Porretti*, chairman of the Christmas Party committee, announced that the party would be held at D'Angelo's Restaurant on December 12th. The next regular meeting will be held in January.

*Nicholas Topazio*
Publicity Director

**Detroit Branch**

The third meeting of the 1957-58


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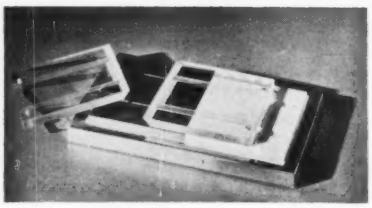
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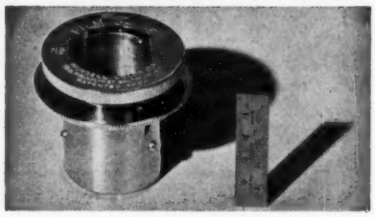
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series was held on Friday, Nov. 1 at the Statler Hotel in Detroit. This was a joint meeting with the Plating Institute of Michigan and was opened by Branch President *Glenn Friedt, Jr.*, at 8:15 P. M. Branch Secretary *Ed Kubis* introduced 15 applicants for membership and, with their acceptance, brought the branch enrollment to 694.

*Webb Knight, Sr.*, president of the Knight Plating Co. and president of the Plating Institute of Michigan served as technical chairman and, prior to introducing the evening's speaker, gave an enlightening talk outlining the structure of the Institute, its purpose and programs, and the success it has enjoyed to date.

The speaker of the evening, *Allen R. Klomps*, Sunbeam Corp., Chicago, gave a very informative talk on Sunbeam's experience with production copper plating with P.R. Mr. Klomps covered all phases of the subject from the selection of the proper equipment, solution make-up, current densities, what to expect in uniformness and leveling, filtering and cooling the solution.

The Branch expressed their appreciation to Mr. Klomps for an interesting talk and the meeting adjourned at 10 P.M. at which time refreshments were served.

*Robert J. Amis*
Publicity Chairman

**British Columbia Branch**

The November 18 meeting was held at White Spot, 25th & Cambie with 15 members and guests present. Minutes of the previous meeting were read and adopted.

*J. Lee* advised that the December meeting would take the form of a tour of the B. C. Research Council building in the University area followed by refreshments at the "Dolphin" restaurant; wives were to be invited also. *W. Kellerman* reported on the progress of the night school course and obtained permission to order 15 METAL FINISHING GUIDEBOOKS for distribution to the students.

The speaker of the evening was *John Mungenast* of General Electric Co., who showed wide-screen slides of various aspects of germanium and silicon rectifier development accompanied by a commentary of their problems, which was followed by a question and answer period whose variety of inquiry proved how interesting the speaker's topic and talk had been.

*J. Lee*
Secretary

**Southeastern Branch**

On 8 November, *H. L. Benner* of Dupont, spoke to the Branch on the "Effects of Impurities in Cyanide Plating Solutions", illustrating with color slides of test panels and answering many questions. The application for membership of *Sam L. Huffman*, Carolina Plating and Stamping Co., Greenville, S. C., was announced.

*Howard Bone*, chairman of the 1958 Technical Session Committee reported on the progress of the committee. The 3rd Annual Technical Session with participation of Miami and Blue Ridge is shaping into the biggest plating festival ever held in the South. Speakers for the occasion are *Vandenburg* of Alcoa,


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*Robert H. Probert,*
Secretary & Treasurer

### Springfield Branch

The Springfield Branch met at Blake's Restaurant, on Monday evening, Oct. 28, for the regular monthly business meeting and technical session. After a tasty steak dinner, a short business meeting was called by President *Charles F. Griffin, Jr.* to choose delegates and alternates to the Cincinnati Convention next May.

The following were named: Delegates — *Harold L. Mitchell, Edward F. Koetsch, Jr.,* and *Elery C. Gibson;* Alternates — *Robert J. Girard, Charles F. Griffin, Jr.,* and *Earnest E. Couture.*

For the technical session, those present enjoyed a very enlightening explanation and discussion on "Rectifiers — and How They Work," by *Frank Schneiders,* service engineer, Enthone, Inc., New Haven, Conn. Frank had a mock-up unit with individually controlled manually operated switches, which were tied in with an oscilloscope, to visually portray actual results obtained with electric power. There was a great deal of interest, and many questions when the discussion period ended.

*Henry L. Heisefeld*
Secretary

### Twin City Branch

The Twin City Branch held its November meeting on the 4th, at Jax Cafe in Minneapolis, Minn. Forty-six per cent of the membership attended this meeting.

An interesting and informative lecture on decorative anodizing and dyeing of aluminum was delivered by the guest speaker, *Joseph Andrus,* of Croname Inc., Chicago, Ill. A short question and answer period followed.

*John M. Zangs, Jr.*
Librarian

### Chicago Branch

The regular meeting of the Chicago Branch was held at the Western Society of Engineers on Friday, November 1, 1957. The technical program began with *Dr. Russ Harr* introducing the speaker of the evening, *Leonard Weeg,* superintendent of finishing, National Lock Co., Rockford, Ill. His subject was "Barrel Finishing." He pointed out that experience was necessary in any barrel finishing operation and that labor and materials are the primary costs to be considered. The different types of hardware as processed by the finishing department were then circulated throughout the audience and a question and answer period followed.

*Christopher Marzano,*
Publicity Chairman

### Dayton Branch

The twelfth annual Educational Session and Dinner Dance will be held on Saturday, March 1, 1958 at the Hotel Biltmore.

### First President of the Society of Vacuum Coaters

*Thomas J. LaBounty* was elected the first president of the *Society of Vacuum Coaters* at their organizational meeting in Cleveland, October 30-31, an account of which appeared in our December issue.

Mr. LaBounty received a B.A. from St. Bede College and studied Industrial Engineering at Illinois Institute of Technology, as well as Business Management at Northwestern University. He is a vice president of Logo, Inc.



Thomas J. La Bounty

Division, Bee Chemical Company, specialists in coatings for plastics. Prior to joining Bee Chemical Company, he was vice president of Multi Plastics, a vacuum impregnating firm. The new society is now making plans for a Detroit meeting next October. Those interested in presenting a paper on the technical and practical applications and techniques involved in functional and decorative vapor deposition are asked to send a 100-word abstract as soon as possible to *F. Gruen,* program chairman, Syn-Cote Chemical Corp., 44-27 Turvis St., Long Island City 1, New York. His telephone number is STillwell 4-5297.

### NATIONAL ASSOCIATION OF METAL FINISHERS

*Lawrence J. Hay,* Plating Service Co., Chicago, has been named to the board of directors of the NAMF. He fills the unexpired term of *Edward H. Fell,* Atlas Plating Works, Cicero, Ill., who resigned several months ago when he entered a new field of endeavor.

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Chicago's most efficiently run job shops, served as chairman, vice chairman and director of the Chicago Electro Platers' Institute, the NAMF affiliate in the Windy City. He, also, held the positions of vice president and director of the one-time National Federation of Metal Finishers. The charter member of the NAMF is also a member of the Chicago branch, A.E.S.

**Leonard Heads Drive For New Members**

*A. T. Leonard*, president of Superior Plating Inc., Minneapolis, was named to lead the first annual drive for members of an international metal finishing management executives association. Head of one of the job shop plating industry's largest firms, Mr. Leonard started with his present firm at the age of 12 when he worked part time through high school. He attended the University of Minnesota Evening School for ten years while he worked full time at Superior Plating, pursuing courses in chemistry and metallurgy. In addition, he had taken several courses in business administration at the Harvard School of Business.

The 45-year-old NAMF drive chairman, a Horatio Alger in his own right, employs more than 300 people. His firm does more than $3 million a year in sales and his 150,000 square foot plant does no manufacturing.

Active in local and national affairs, Mr. Leonard is a member of the Electroplating Industry Advisory Committee, a top Federal government post; past president and past chairman of the Twin Cities branch, American Electroplaters' Society; and past chairman of the Twin Cities chapter, Young Presidents' Organization. Mr. Leonard is also a part-time lecturer at the University of Minnesota.

The NAMF member sign-up period is between February 1 and March 31, 1958. Drive highlight is the official kickoff, slated for January 25, 1958, at the Conrad-Hilton Hotel, Chicago, where chairman Leonard will meet with divisional chairmen and local members. The Windy City affair is under the direction of the NAMF affiliate there, the Chicago Electro-Platers Institute, and is scheduled to start at 9 a.m. A cost session will follow kick-off ceremonies.

## FEDERATION OF PAINT AND VARNISH PRODUCTION CLUBS

The premiere presentation of the Roon Foundation Awards, established this year by *Leo Roon*, former president of *Nuodex Products Co., Inc.* and head of the Foundation, were made at the banquet of the 35th annual meeting of the *Federation of Paint and Varnish Production Clubs* in Philadelphia on November 1, 1957. Six technical papers by eight authors were awarded cash prizes amounting to $1500.00.

The awards were initiated for the purpose of encouraging the contribution of papers of scientific importance and practical value to the protective coatings industry from individuals associated with the industry, including raw material suppliers and educational institutions. The competition is divided into two classes: (1) Class A—limited to Class A members of the Federation (2) Open Competition—open to anyone involved in study of or engaged in work related to the protective coatings industries. The Federation, as sponsors of the competition, supervises the judging of the papers which do not necessarily have to be presented at the Annual Meeting in order to qualify for an award.

*Dr. Joseph W. Tomecko*, of Canadian Industries, Ltd. in Montreal, was installed as the 36th president during the business session. He assumes the presidency of the 4000-member technical society of the coatings industry after having served as president-elect in 1956-57 and as chairman of several key committees in previous years.

Dr. Tomecko has been associated with the protective and decorative coatings industry for 17 years, all with Canadian Industries, Ltd. At present he is the assistant general manager of the Paints Division.


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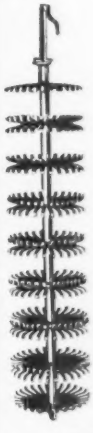
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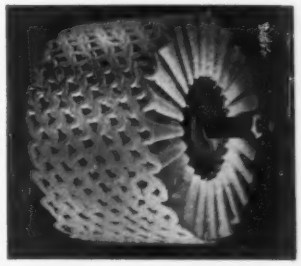
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**WE CARRY A COMPLETE LINE OF NEW AND REBUILT PLATING AND POLISHING EQUIPMENT.**

**CLINTON SUPPLY COMPANY**
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Select from one of the nation's largest stocks of guaranteed rebuilt electroplating motor generator sets and rectifiers with full control equipment.

**PLATERS**

1—10,000/5000 AMPERE, 6/12 VOLT. **H-VW-M** Synchronous. Exc.-in-head.
1—8000/4000 AMPERE, 6/12 VOLT. **CHANDEYSSON,** Synch.
1—7500/3750 AMPERE 9/18 VOLT. **HANSON - VAN WINKLE - MUNNING,** Synchronous.
1—6000/3000 AMPERE, 6/12 VOLT. **ELECTRIC PRODUCTS,** Synch.
2—5000/2500 AMPERE, 9/18 VOLT. **CHANDEYSSON,** Synchronous. Exciter-in-head.
1—4000/2000 AMPERE, 6/12 VOLT. **H-VM-M,** Synch., Exc.-in-head.
3—3000/1500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Exciter-in-head.
1—2000/1000 AMPERE, 6/12 VOLT. **HANSON - VAN WINKLE - MUNNING.**
1—1500/750 AMPERE, 12/24 VOLT. **CHANDEYSSON,** Synchronous.

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1—1000 AMPERE, 40 VOLT. **CHANDEYSSON,** 25°C.
1—1000 AMPERE, 30 VOLT. **IDEAL,** Exciter-in-head.
1—750 AMPERE, 60 VOLT. **HANSON-VAN WINKLE-MUNNING,** Synchronous, Exciter-in-head.
1—500 AMPERE, 25 VOLT. **CHANDEYSSON,** Synchronous, Exciter-in-head.
4—400 AMPERE, 40 VOLT. **M.G.C.,** Separately Excited.

**RECTIFIERS**

1—2000/1000 AMPERE, 6-12 VOLT. **G.E.**
1—**SEL-REX** SELENIUM, 1200 AMPS. 9 V. for 440/3/60.
1—1500/750 AMPERE 6/12 VOLT, **UDYLITE-MALLORY.**
4—1440/720 AMPERE, 6/12 VOLT, **UDYLITE-MALLORY.**
1—**RAPID** 1000 AMPERE, 12 VOLTS Germanium, 440/3/60.
1—**RAPID** 750 AMP, 6 VOLT SELENIUM REMOTE CONTROL, 440/3/60 AC.

**SPECIAL**

2—**CROWN & H-VW-M** Centrifugal Driers No. 1 and No. 2 with Heat.
1—**HAMMOND VRO-7** Variable Speed Buffing Lathe, 7½ H.P.
1—**H-VW-M** Semi-Automatic for Cyanide. 15 ft. x 60 in. x 42 in. Can be lined for nickel.
2—**RONCI** Enamelers, Nos. R-100 & R-200.
1—**ALMCO** DB8 Deburring Barrel, 2 Comp. Vari Drive.
1—**ALMCO** DB-2 Deburring Bbl. lined.
2—No. 101 Production Pipe Polishing Machines.
1—**No. A-2 ACME** semi-automatic 2 spindle buffing head.

Other outstanding values in stock. You'll save more if you check M. E. Baker first for all your plating, anodizing and metal finishing needs.

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## QUALITY EQUIPMENT

**PRICED RIGHT AND READY FOR IMMEDIATE DELIVERY**

~

**PLATING EQUIPMENT**

30 Plating Barrels: Crown — Udylite — HVWM — various sizes.

4 Industrial Filter Units; Model RDR2 Rubber lined with slurry tanks for nickel solution; 2000 gal. per hr. motor AC 3 ph. size 18x48 complete.

6 Semi-Automatic Plating Tank Units: Udylite 20' — HVWM 20' — Crown 35' — U. S. Galvanizing 12', 16' and 20'.

1 HVWM 4 station Plating Barrel Unit: 36x14; rubber lined tank, rubber cylinders.

4—Industrial RDR2 rubber lined filters & slurry tanks. 4500 gal. per hr. Sizes 36-36-30 with AC 3 ph. motor complete.

3 Blakeslee Niagara Single Stage Motor Driven conveyor washers 8' long with 18" wide belt.

10-Mears Kane Ofeldt gas fired steam tubular boilers. 2-20 HP with pump units.

10 Centrifugal Dryers: acid crocks, motor driven exhaust fans, fume blowers, complete acid and dip rooms, cleaning and washing tanks, plating racks and many other items.

30 Rubber lined Nickel Plating Tanks: 2' to 12' long; with rods, rheostats, motor driven tank rod agitators, heating coils, etc.

16 DETREX, BLAKESLEE, CIRCO, Steam, Gas and Electrically Heated Degreasers: 3' to 6' long, single dip and 3 dip type, with pumps, tanks, fume ducts.

12 STEINER IVES and GEHNRICH Paint Baking and Drying Ovens: electric, all sizes; full automatic, recirculating type with controls, fans, blowers.

CHANDEYSSON: 1000 amps to 5000 amps.
HVWM: 500 amp. - 5000 amp.
HOBART: 100 amp. - 2000 amp.
COLUMBIA: 1000 amp. - 4000 amp.
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AMERICAN GIANT: 250 amp. - 4000 amp.

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ALL SIZES — TUMBLING BARRELS: Abbott — Baird; complete with stones and steel balls.

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# READY-REFERENCE SECTION
## —USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

## PRICED RIGHT FOR QUICK SALE

1—Rampe Shaker.
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1—Crown Portable plating barrel (all solutions).
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1—L'Hommedieu 3 H.P. variable speed Buffer 1500-2000 R.P.M.
9—U. S. Electrical 5 H.P. variable speed Buffers (Sacrifice).
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1—Periodic Reverse Unit 250 Amperes.
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2—Belke Tilting Tumblers — wood lined.
55—Tank Rheostats, Knife Switches all capacities.
20—Blowers and Motors (multivain-fume) (paddle wheel-dust).

TANKS — ALL SIZES AND LININGS
Rectifiers — 25 Amperes to 10,000 Amperes
Airbuffs — Compounds — Anodes — Chemicals, etc.
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6—G.E. 6 v. 500 ampere units w/new selenium stacks, $325.00.
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1—Rapid 24/48 volt, 4000/2000 ampere with new Germanium Stacks.
1—Chandeysson MG Set 6000/3000 amp. 6/12 volt 300 R.P.M. complete.
1—Bogue MG Set 5000/2500 amp. 6/12 v.
1—Jantz-Leist 1660/830 amp. 12/24 v.
1—G. E. 1500 amp. 6 v. MG set.
1—Bogue Generator 3000/1500 amp. 6/12 volts.
1—H.V.W. 6000/3000/1500 amperes 6/12/24 volts.
2—1500 ampere 6 volt rectifiers.
1—1000 Hubart M.G. sets outside, excited.
1—Chandeysson 1000 amp. 6 volt generator.
1—Lektron 1500/750 Amp. 6/12 V.
1—Rapid 2000/1000 amp. 48/24 volt selenium rectifier.
1—Green 1000 ampere 6 v.
1—Lewis 1000 ampere 6 v.
1—Electro-Products 400 amp. 24 v.

**AUTOMATIC POLISHING EQUIPMENT**
1—75' Straight Line, Extrusion & Rectangular Tubing Polishing Machine w/10 Heads, 7-10 H.P. and 3-5 H.P.
11—Acme G-3 144" Belt Sanding Machines.
2—Acme L-8-L fully automatic polishing machines, 8 spindles, each machine comp. w/5, 3, 2 H.P. polishing heads.
2—Acme A-2.
1—Acme E-10 w/A-2 heads.
2—Acme E-10 w/45° angle flat attachment.
1—Packermatic 60" table with 12" centers & 7 polishing heads.
7—3 to 10 H.P. heads for automatic buffing machines.
1—8 spindle semi-automatic buffing machine.
15—Automatic Machine Co. oscillating single spindle semi-automatics, Lefts & Rights.
1—Automatic Machine Co. 1—spindle oscillating RT. angle attachment.

**POLISHING MACHINES**
5—5 H.P. Divine Pol. Mach. also 7½ & 10 H.P.
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3—Hammond Double 5 H.P. Lathes.
1—Hilsey Wolf 5 H.P. Var. speed pol. mach.
4—U. S. #95 Var. speed 5 H.P. pol. mach.
New 5 H.P. Lathes $385.00; 7½ H.P. $445.00.
1—Pesco Double 5 H.P. Lathe.
15—Pesco & Pesco type 3-5-7½ H.P. polishing lathes.

**TUBE POLISHING EQUIPMENT**
1—Type "S" Production Tube Polisher, up to 1-¼" tubing.
1—Production #101.
1—Type "A" Production Tube Polisher up to 6" tubing.
1—Hammond OD-9.

**MISCELLANEOUS**
1—Gas Baking Ovens 78" high, 72" deep, 36" wide, I.D. with all controls.
LaSalco 14" x 42" complete line, cleaning, plating, rinsing, melamine barrels.

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6—Alsop NR & WR 5" & 7" steel & stainless steel.
19—Various makes steel and stainless steel.

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Udylite 16" x 42" Lucite Cylinders, cleaning, pickling, plating & rinse line with 6-16" x 42" lucite cylinders, ideal for cadmium or zinc.
1—Daniels #8.
1—Stevens 6 barrel 20' horseshoe type semi-automatic w/6 extra barrels.
1—#3 Rubber Lined Daniels.
1—#4 Rubber Lined Daniels.

**TUMBLING EQUIPMENT**
2—New LaSalco Tilting Type.
2—Almco 32" x 32".
6—Abbotts 8" x 30", 16" x 30" single and double, belt and motor driven.
10—Baird #1 Stand motor driven.
2—Globe Tumbling Barrels.
3—Henderson Tumbling Barrels.
2—Crown #452 2 Comp. Neoprene lined 5 H.P. Vari Drive.

**DRYING EQUIPMENT**
1—18" Crown Centrifugal.
2—18" Mercil Centrifugal.

**DEGREASERS**
1—28' Detrex Conveyorized.
1—15' Barrel Type Detrex Degreaser.
20 Degreasers 14" to 7' all makes, steam, gas, electric.

**TANKS**
1—16" x 42" x 36" steel rubber lined.
200—S.S., Monel, Steel, Brick, Lead, Rubber Lined, all sizes.

## Pesco Plating Equipment Corp.

**Plating, Polishing, Grinding, Spraying, Baking, Drying, Tumbling, Cleaning, Degreasing & Anodizing Equipment. Anodes, Chemicals, Acids, Cyanides, Solvents, Supplies for Wood, Plastics and Metals.**

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## HEAT EXCHANGERS — PUMPS
## GEARED HEAD MOTORS

**RECTIFIERS**
1—4000 Amp., 12 Volt Bart-Messing
1—3000 Amp., 18 Volt Hanson-Van Winkle
1—3000 Amp., 6 Volt Bart-Messing
1—2000 Amp., 6 Volt Hanson-Van Winkle
2—1500 Amp., 6 Volt Richardson-Allen
1—1000 Amp., 6 Volt Hanson-Van Winkle

**MOTOR GENERATOR SETS**
1—2500/1250 Amp. H-V-W, 6/12 volts
1—3200 Amp. General Electric, 24 volt
1—1600 Amp. General Electric, 24 volt
1—1000 Amp. Century, 24 volt
1—750 Amp. Westinghouse, 24 volt

**HEAT EXCHANGERS**
2—Industrial 12 Graphite Tubes, 6400 gal-lon heating, 320,000 BTU cooling
1—Industrial 6 Graphite Tubes, 4800 gal-lon heating, 160,000 BTU cooling

**PUMPS**
10—Sump Pumps 1 HP to 7½ HP
15—LaBour, Industrial, lead lined, stainless steel and Duriron Centrifugal Pumps

**EXHAUST FANS**
10—Buffalo size 450C, 450D, 400D and 375C vent sets

**MOTORS**
10—½ & 1 HP Boston ratio motors for oscillation motions
4—2 & 3 HP geared head agitators

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146-148 GRAND STREET, NEW YORK 13, N. Y. Phone: CAnal 6-6976
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## EQUIPMENT FOR SALE

4—10000/5000 Amp. 9/18 Volt, Chandeysson Motor Generator Sets, with Direct Connected Exciters, Panels and Starters, Synchronous Driven, 300 RPM. (1943 Machines) used less than 2 years, like new condition. All 4 machines identical and presently located in Milwaukee, Wis. Motors are presently arranged for 2200 volt 3 phase, 60 cycle operation, but will reconnect for either 440 or 220 volt hook-up.

**ALAN BAKER COMPANY**
180 Sylvester Road
South San Francisco, Calif. Plaza 5-6506

## PLATING EQUIPMENT FOR SALE

3—Plating Motor Generator sets, 6/12 volt:
1—Columbia, 3000 amps. at 6 volts, type XED, 900 RPM, dual commutator, direct connected exciter driven by 30 HP synchronous motor 220/440/3/60. Ball bearing, AC & DC panels.
2—Ideal, 5000 amps. at 6 volts, type HP, 495 RPM dual commutator, driven by 50 HP Ideal induction motor 440/3/60 (will reconnect to 220 volt) complete with exciter, generator set and DC panels.

Units in first class condition, and complete with miscellaneous lead lined, rubber lined and steel tanks. Total 13,000 amps. at 70 cents per amp. with tanks, F.O.B. Erie, Pa.

Address: December 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

ADVERTISING RATES
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## —USED EQUIPMENT AND SUPPLIES—

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ETC.

## PLATERS AND ANODIZERS

M-G SETS — Motor 3-60-220/440

| Amp. | Volt | Make |
|---|---|---|
| 175 | 14 | Delco |
| 200 | 7½ | Chandeysson |
| 300 | 7½ | Hobart |
| 400 | 60/60 | G. E. |
| 750/375 | 6/12 | Excel |
| 940 | 32 | Elec. Prod. |
| 1000/500 | 6/12 | Chandeysson |
| 1500/750 | 6/12 | H-V-W |
| 1500 | 15 | Star |
| 1500 | 30/50 | Century |
| 1500 | 40/65 | G. E. |
| 1500 | 65 | Westinghouse |
| 1500 | 70 | Century |
| 2500/1250 | 6/12 | Elec. Prod. |
| 5000/2500 | 6/12 | Chandeysson |
| 5000/2500 | 6/12 | Columbia |
| 5000/2500 | 9/18 | Chandeysson |

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5,000 Amp., 50 mv.
6,000 Amp., 50 mv.
10,000 Amp., 50 mv.
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**MOTOR REPAIR & MANUFACTURING CO.**
1555 HAMILTON AVE., CLEVELAND, OHIO

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Custom or production painting shop wanted, size not too important as long as potential for expansion exists. Must be located in eastern half of United States. Address: January 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

## Pure Titanium Bolts — Nuts

### STUDS - WASHERS
### HEX. HEAD BOLTS

(Price each in 1,000 lots)

| ¼ - 20 | | | | 10 - 24 | | |
|---|---|---|---|---|---|---|
| ¾" | 1" | 1½" | 2" | ½" | 1" | 1½" |
| .25 | .30 | .36 | .48 | .17 | .21 | .25 |

(1-99 plus .10 ea. — 100-999 plus .05 ea.)

### ROUND HEAD BOLTS

(Price ea. in 100 lots)

| ¼ - 20 | | | 10 - 24 | |
|---|---|---|---|---|
| ¾" | 1" | 1¼" | 1" | 1¼" |
| .21 | .25 | .30 | .15 | .18 |

(1-99 plus .05 ea.)

| STUDS | | | SQUARE NUTS | |
|---|---|---|---|---|
| ¼ - 20 | | | ¼ - 20 | .18 |
| 1" | 1½" | 2" | 10 - 24 | .13 |
| .18 | .20 | .22 | | |

(Prices in 1,000 lots)

(1-99 plus .10 ea.) (1-99 plus .05 ea.)
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WAlnut 1-3800

## EQUIPMENT FOR SALE

2—H-VW-M full automatic plating machines used for metal furniture. Capacity, 200 chairs and table legs per hour.
1—6000/3000 amp. 6/12 volt H-VW-M synchronous MG set.
1—10,000/5000 amp. 6/12 volt H-VW-M synchronous MG set.
1—Industrial rubber lined filter, type RDR. Capacity, 8000 GPH.
Address: Box 221, Williamsville 21, N. Y.

## AUTOMATIC BUFFING MACHINE FOR SALE

7' 6" table, 16 spindle, rotary indexing, A-1 condition — $2500.00.
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MACHINE SHOP & RESIDENCE in northwest Pennsylvania. Established 1929. Excellent location, large living quarters. Ask $35,000. Write B-42951.

MACHINE SHOP in south central Michigan. Established 1946. Three acres, industrial area. Expansion possible. Ask $50,000. Write B-62459.

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Yearly (12 times) 8.00

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## —USED EQUIPMENT AND SUPPLIES—

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## SITUATIONS OPEN

### BUFFING COMPOUND SALESMEN

SITUATION OPEN — Distributors, jobbers and manufacturers agents wanted to distribute and sell the full line of Schaffner's polishing and buffing composition in bar, spray or paste form, and a complete line of polishing room supplies.

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SITUATION OPEN—Well established metal goods manufacturer located near Allentown, Pa. has opening for well qualified supervisor experienced with all types of rotary automatic and hand polishing equipment on high quality brass plate. Should have knowledge of brass, bright nickel and chrome plating. Applicants must have leadership as well as demonstrated technical ability. Salary commensurate with background and abilities. Send complete resume, including salary required. Address: January 2, care Metal Finishing, 381 Broadway, Westwood, N. J.


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FINISHING PUBLICATIONS, INC.
381 Broadway
Westwood, N. J.


### CHEMIST

SITUATION OPEN—Chemist for plating laboratory in large finishing company, Newark, N. J. Experience in analysis and control. Reply submitting full resume of experience to May 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

### TECHNICAL DIRECTOR

SITUATION OPEN—Medium size shop. Burnishing, copper barrel plating, nickel barrel plating and gold barrel plating of small parts. To be in complete charge of time study, work flow analysis, quality control and price estimates. Salary $9,000 to start. Advancement to assistant general manager and eventually to general manager. Address: October 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

### ELECTRO ENGINEER

SITUATION OPEN—Must have plating experience in brass, cadmium, copper, nickel and chrome. Capable of laboratory and quality control. Must have oxidizing knowledge. Reply submitting full resume of experience. Address: January 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

## SITUATIONS WANTED

### PLATING SUPERVISOR

SITUATION WANTED—16 years of job shop and manufacturing production plating experience. Also anodizing, dyeing and bright finishes. Analyze all solutions. Excellent chemical and metallurgical background. Ohio resident. Locate anywhere. Address: January 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

### PLATING FOREMAN

SITUATION WANTED—21 years experience in plating barrels and still tanks. Can maintain the following solutions: copper, brass, zinc, cadmium and bright nickel. Have a knowledge of deburring and burnishing barrels. The last ten years were spent in supervisory capacity. Salary optional.

NAT HIRSCH
25 Clarke Place Bronx 52, N. Y.
Wyandotte 2-4143

### PLATING EXECUTIVE

SITUATION WANTED—I have experience in all types of decorative plating — cadmium, heavy silver, hard chrome; also phosphatizing, electropolishing of stainless steel, and anodizing. Have also had as many as forty men and women under my supervision. Address: November 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

### FINISHING MANAGER

SITUATION WANTED—Management position wanted by high caliber man in manufacturing plant or large job shop. Prefer midwest location. Completely experienced to handle personnel, union relations, solutions and equipment. Salary plus bonus in the $15,000 range. Resume upon request. All replies answered. Address: December 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

### PLANT MANAGER

SITUATION WANTED — Seventeen years experience. Analyze and control all solutions; fully capable in barrel, still or automatic operations and have developed several plating methods, including barrel chrome. Have also supervised up to 60 in polishing, plating and lacquering and built several plants, one a full automatic. Address: November 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

### FOREMAN PLATER

SITUATION WANTED (in Florida area only)—Twenty-five years experience in copper, nickel, chromium, silver, brass, cadmium-zinc, phosphate coatings. Barrel and still tank operation; polishing, buffing and job or production work. Forty years old, married 17 years, have 3 children. Address: December 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

## 45th ANNUAL CONVENTION OF THE A.E.S.

**MAY 19-22, 1958**

*CINCINNATI BRANCH — HOST*
*CINCINNATI, OHIO*

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**Atlantic Compound Co.**
1860 Baldwin St., Waterbury, Conn.
**Automotive Rubber Co.** 14
12550 Beech Rd., Detroit 39, Mich.
**Atlas Mineral Products Co.** 91
Mertztown, Pa.
**Bacon Felt Co.**
437 W. Water St., Taunton, Mass.
**Baird Machine Co.** 73
Stratford 9, Conn.
**Baker Co., Alan** 111
180 Sylvester Rd., South San Francisco, Calif.
**Baker Co., The M. E.** 110
25 Wheeler St., Cambridge 38, Mass.
**Barker Bros., Inc.** 91
1660 Summerfield St., Brooklyn 27, N. Y.
**Battelle Development Corp.**
Columbus 1, Ohio
**Beam-Knodel Co.** 96
195 Lafayette St., New York 12, N. Y.
**Beck Equipment Co.** 97
3352 W. 137th St., Cleveland 11, Ohio
**Behr-Manning Corp.**
Troy, N. Y.
**Belke Manufacturing Co.** 31
947 N. Cicero Ave., Chicago 51, Ill.
**Better Finishes & Coatings, Inc.** 84
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**Brucar Equipment & Supply Co.** 111
602-604 20th St., Brooklyn, N. Y.
**By-Buk Co.**
4314 W. Pico Blvd., Los Angeles 19, Calif.
**Ceilcote Co., Inc., The**
4832 Ridge Rd., Cleveland 9, Ohio
**Chandeysson Electric Co.** 27
4074 Bingham Ave., St. Louis 16, Mo.
**Chemical Corp., The** 107
58 Waltham Ave., Springfield, Mass.
**Circo Equipment Co.**
51 Terminal Ave., Clark Twp. (Rahway), N. J.
**Clair Manufacturing Co., Inc.**
Olean, N. Y.
**Cleveland Process Co.** 77
1965 E. 57th St., Cleveland 3, Ohio
**Clinton Supply Co.** 110
112 S. Clinton St., Chicago 6, Ill.
**Cohn Mfg. Co., Inc., Sigmund** 32
121 S. Columbus Ave., Mt. Vernon, N. Y.
**Columbia-Southern Chemical Corp.** 8, 9
One Gateway Center, Pittsburgh 22, Pa.
**Continental Metals, Inc.** 92
7001 Santa Monica Blvd., Los Angeles, Calif.
**Conversion Chemical Corp.**
98 E. Main St., Rockville, Conn.
**Cowles Chemical Co.** 72
7014 Euclid Ave., Cleveland 3, Ohio
**Crown Rheostat & Supply Co.** 29
3465 N. Kimball Ave., Chicago 18, Ill.
**Davies Supply & Mfg. Co.** 103
4160 Meramec St., St. Louis 16, Mo.
**Davis-K Products Co.**
135 W. 29th St., New York 1, N. Y.
**Dean Thermo-Panel Coil Div., Dean Products, Inc.** 104
613 Franklin Ave., Brooklyn 38, N. Y.
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Toledo 1, Ohio
**Diamond Alkali Co.**
300 Union Commerce Bldg., Cleveland 14, Ohio
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243 Fourth Ave., Brooklyn 15, N. Y.
**Dixon & Rippel, Inc.**
Box 116, Saugerties, N. Y.
**Dow Chemical Co., The**
Midland, Mich.
**Drying Systems Co.** 106
1830 Foster Ave., Chicago 40, Ill.
**Du Pont de Nemours & Co., E. I.**
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**Electronic Rectifiers, Inc.** 98
2102 Spann Ave., Indianapolis 3, Ind.
**Enthone, Inc.** 3
442 Elm St., New Haven, Conn.
**Formax Mfg. Corp.** 96
3171 Bellevue, Detroit 7, Mich.
**G. S. Equipment Co.** 24
15585 Brookpark Rd., Cleveland 11, Ohio
**Gerson Co., Louis M.** 112
Box 175, Mattapan, Mass.
**Glo-Quartz Electric Heater Co., Inc.** 95
Willoughby, Ohio
**Graver Water Conditioning Co.**
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**Guaranteed Buff Co., Inc.** 109
20 Vandam St., New York 13, N. Y.
**Gumm Chemical Co., Inc., Frederick** Inside Front Cover
538-542 Forest St., Kearny, N. J.
**Hamilton Emery & Corundum Co.** 108
Chester, Mass.
**Hammond Machinery Builders, Inc.** 85, 93
1601 Douglas Ave., Kalamazoo 54, Mich.
**Hammond Solvents Recovery Service** 112
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**Hanson-Van Winkle-Munning Co.** 74A-D, 79
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**Harrison & Co., Inc.** 104
487 Groveland St., Haverhill, Mass.
**Harshaw Chemical Co., The** 19
1945 E. 97th St., Cleveland 6, Ohio
**Henderson Bros. Co.**
136 S. Leonard St., Waterbury, Conn.
**Holland & Sons, Inc., J.** 110
475 Keap St., Brooklyn 11, N. Y.
**Hooker Electrochemical Co.**
1303 Union St., Niagara Falls, N. Y.
**Ideal Chemical Co.** 112
1499 Dean Dr., So. Euclid 21, Ohio
**Illinois Water Treatment Co.**
840 Cedar St., Rockford, Ill.
**Industrial Filter & Pump Mfg. Co.** 11
5906 Ogden Ave., Chicago 50, Ill.
**Infilco, Inc.**
912 S. Campbell Ave., Tucson, Ariz.
**Ionic Electrostatic Corp.**
111 Monroe St, Garfield, N. J.
**Jelco Finishing Equipment Corp.**
153 E. 26th St., New York 10, N. Y.
**Kaykor Industries, Inc.**
4400 Broad St., Yardville, N. J.
**Klem Chemicals, Inc.** 94
14401 Lanson Ave., Dearborn, Mich.
**Kocour Company** 83
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**Koehler Instrument Co., Inc.** 106
168-56 Douglas Ave., Jamaica 33, N. Y.
**Kosmos Electro-Finishing Research, Inc.**
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**Kramer Co., H. W.** 90
120-30 Jamaica Ave., Richmond Hill 18, N. Y.
**Kushner, Joseph B.** 108
Stroudsburg, Pa.
**Land, Inc., L. J.** 111
146-148 Grand St., New York 13, N. Y.
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2818-38 Lasalle St., St. Louis 4, Mo.
**Lea Mfg. Co.** 34A
16 Cherry Ave., Waterbury 20, Conn.
**Lea Michigan, Inc.**
14066 Stansbury Ave., Detroit 27, Mich.
**Lea-Ronal, Inc.** 34B
139-20 109th Ave., Jamaica 35, N. Y.
**Leiman Bros., Inc.** 101
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**L'Hommedieu & Sons Co., Chas. F.** 5
4521 Ogden Ave., Chicago, Ill.
**Lowe Brothers Co., The**
Dayton 2, Ohio
**Macarr, Inc.** 103
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Waterbury 20, Conn.
**Manhattan Rubber Div., Raybestos-Manhattan, Inc.**
6 Willett St., Passaic, N. J.
**Mearl Corp., The**
124 E. 40th St., New York 16, N. Y.
**Metal & Thermit Corp.** 38
Rahway, N. J.
**Michigan Abrasive Co.** 35
11900 E. 8 Mile Rd., Detroit 5, Mich.
**Michigan Buff Co.** 112
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**Michigan Chrome & Chemical Co.** 10
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Wampus Lane, Milford, Conn.
**Motor Repair & Mfg. Co., The** 112
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**Murray-Way Corp.** 87
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61 Broadway, New York 6, N. Y.
**Nankervis Co., Geo. L.**
15300 Fullerton Ave., Detroit 27, Mich.
**Narda Ultrasonics Corp., The** 34
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2727 Avondale, Toledo 7, Ohio
**New Holland Machine Co.**
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**New Jersey Metals Co.**
712 Rockefeller St., Elizabeth 2, N. J.
**Nordson Corporation**
Amherst, Ohio
**Northwest Chemical Co.**
9310 Roselawn Ave., Detroit 4, Mich.
**Norton Co.**
1 New Bond St., Worcester 6, Mass.
**Oakite Products, Inc.** 4
18 Rector St., New York 6, N. Y.
**Packer Machine Co.** 82
456 Center St., Meriden, Conn.
**Pennsalt Chemicals Corp.** 80, 81
3 Penn Center Plaza, Philadelphia 2, Pa.
**Pesco Plating Equipment Corp.** 111
75 Wythe Ave., Brooklyn 11, N. Y.
**Pfizer & Co., Inc., Chas.** 15
630 Flushing Ave., Brooklyn 6, N. Y.
**Phoenix Abrasive & Chemical Co.** 100
657 Berriman St., Brooklyn 8, N. Y.
**Plating Products, Inc.** 97
1509 N. Washington, Kokomo, Ind.
**Potter Paint Co., Inc.**
21 Crawford St., Cortland, N. Y.
**Promat Div., Poor & Co.**
851 S. Market St., Waukegan, Ill.
**Ramco Equipment Corp.**
807 Edgewater Rd., New York 59, N. Y.
**Ransburg Electro-Coating Corp.**
1200 Barth Ave., Indianapolis 7, Ind.
**Rapid Electric Co.** 13
2891 Middletown Rd., Bronx 61, N. Y.
**Raybestos-Manhattan, Inc. Manhattan Rubber Div.**
Passaic, N. J.
**Reynolds Chemical Products Co.**
1200 N. Main St., Ann Arbor, Mich.
**Rona Laboratories, Inc.** 107
356 Doremus Ave., Newark, N. J.
**Saran Lined Pipe Co.** 7
2415 Burdette Ave., Ferndale 20, Mich.
**Sarco Co., Inc.**
635 Madison Ave., New York 22, N. Y.
**Schaffner Mfg. Co., Inc.** 6
Schaffner Center, Emsworth, Pittsburgh 2, Pa.
**Schori Process Div., FerroCo Corp.** 34
8-11 43rd Rd., Long Island City, N. Y.
**Schultz & Co., Jack W.**
7550 Melrose Ave., Los Angeles 46, Calif.
**Sel-Rex Corp.** Inside Back Cover
75 River Rd., Nutley 10, N. J.
**Service Screw Products Co.** 109
131 N. Green St., Chicago 7, Ill.
**Sethco Mfg. Co.** 99
2286 Babylon Turnpike, Merrick, L. I., N. Y.
**Shell Chemical Corp.**
380 Madison Ave., New York 17, N. Y.
**Sieferi Co., J. J.** 20
5643 Lauderdale, Detroit 9, Mich.
**Simonds Abrasive Co.**
Tacony & Fraley Sts., Philadelphia 37, Pa.
**Solvents Recovery Service**
1025 Broad St., Newark 2, N. J.
**Sommers Bros. Mfg. Co.** 108
3439 No. Broadway, St. Louis 7, Mo.
**Sparkler Mfg. Co.**
Mundelein, Ill.
**Spee-Flo Corp.** 88
720 Polk Ave., Houston, Texas
**Stevens, Inc., Frederic B.** 23
1808 - 18th St., Detroit 16, Mich.
**Stokes Corp., F. J.** 18
5500 Tabor Rd., Philadelphia 20, Pa.
**Storts Welding Co., Inc.** 102
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**Stutz Co., The**
4430 W. Carroll Ave., Chicago 24, Ill.
**Sulphur Products Co., Inc.** 105
621 W. Pittsburgh St., Greensburg, Pa.
**Technic, Inc.** 37
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**Ther Electric & Machine Works**
19 So. Jefferson St., Chicago 6, Ill.
**Tranter Mfg., Inc.** 30
Lansing 4, Mich.
**Trerice Co., The H. O.**
1424 W. Lafayette Blvd., Detroit 16, Mich.
**True Brite Chemical Products Co.** 100
P. O. Box 31, Oakville, Conn.
**Udylite Corp., The** 21
Detroit 11, Mich.
**Unit Process Assemblies, Inc.** 107
61 East 4th St., New York 3, N. Y.
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31 Heyward St., Brooklyn 11, N. Y.
**U. S. Stoneware Co.**
Akron 9, Ohio
**Univertical Foundry & Machine Co.** 98
14841 Meyers Rd., Detroit 27, Mich.
**Wagner Brothers, Inc.**
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**Wildberg Bros. Smelting & Refining Co.** 90
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**Worthy Products Co.** 112
Box 3415, St. Paul 1, Minn.
**Wyandotte Chemicals Corp.** 22
Wyandotte, Mich.
**Zialite Corp.** 107
92 Grove St., Worcester 5, Mass.

## Manufacturers' Literature

(*Continued from page* 98)

### Sandblast Machines

*Leiman Bros., Inc.*

A new four-page bulletin illustrates and describes a complete line of cabinet type sandblast machines. Included are standard cabinet type, automatic type with rotating basket inside cabinet, bench type cabinet model for laboratory and small shop, large cabinet type with portable blast nozzle for large pieces, plus a compact motor driven air compressor for plants having no air supply. Complete details of dimensions, construction, work range and operations are given.

**131/Circle on Readers' Service Card**

### Filter Aid

*MacDermid, Inc.*

A filter powder, Metex filter powder, that is compatible with brighteners and never causes roughness in copper, all other cyanide-type and bright nickel solutions, is fully described in Technical Data Sheet No. 28, a three-page usage and instruction sheet.

**132/Circle on Readers' Service Card**

### Belt-Driven Plating Barrel

*Hanson-Van Winkle-Munning Co.*

Savings provided by a newly designed Mercil type belt-driven barrel plating cylinder are explained in a two-color data sheet.

Tables list capacities and dimensions of tanks and apparatus as well as four standard barrel sizes.

**133/Circle on Readers' Service Card**

### Gold Plating

*Sel-Rex Corporation*

Reprints of an article recently published by *William F. Boyle*, chief metallurgist, Federal Telephone and Radio Co., tell how a patented gold plating process has effected tremendous savings in the finishing of various electronic parts, over the method previously used.

The results of various destructive tests to which the gold plate was subjected, costs as compared to other precious metals electroplate, equipment required and a step-by-step procedure for bath preparation, operation, maintenance and control, are also discussed in detail. A section treating a typical plating cycle lists the chronological steps which assure best possible results.

**134/Circle on Readers' Service Card**

### Plating Barrels

*Belke Mfg. Co.*

This new mechanical plating barrel catalog covers all sizes and types from porto-platers to full automatics. It includes double oscillating, variable speed, belt and gear driven cylinders of Plexiglass, Melamine, Tempron Hard Rubber, Transite, Monel, etc., also nickel plating barrel, auto rinse tanks, transfer and storage units, ventilation hoods and ductwork.

**135/Circle on Readers' Service Card**

### Silicones

*Dow Corning Corp.*

Just out, the 1958 reference guide, largest and most complete silicone catalog ever published, describes over 150 commercially available silicone products, including many introduced within this past year. Cross-indexed for ready reference, the sixteen page catalog, Code #1-113, contains detailed charts, tables, graphs and data on properties and performance, along with illustrated examples on how silicones can cut costs, simplify design and add new sales appeal to products in every field of application.

**136/Circle on Readers' Service Card**

### Masking Aids

*By-Buk Company*

"Time Saving Masking Aids for

**January 1958**

**READER SERVICE DEPARTMENT — METAL FINISHING**

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**Name** _____ **Position** _____
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**Company** _____

**Street** _____

**City** _____ **Zone** _____ **State** _____

**We manufacture (products)** _____

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**READER SERVICE DEPARTMENT**

**METAL FINISHING**

**PEOPLES TRUST BUILDING**

**WESTWOOD, NEW JERSEY**

Better Product Finishing" is the title of a new illustrated brochure, M-18, just issued.

"Kwiky-Dot" overlapping masking discs in rolls are featured and a complete line of useful masking plugs, caps, corks, etc., are shown with new convenient dimension tables to simplify size selection. Peelable plastic masking for application at room temperature or in molten form is also described.

A new inexpensive tape dispenser for pressure sensitive tapes is also featured.

137/Circle on Readers' Service Card

### Work Clothes

*Worklon, Inc.*

Latest advances in acid-resistant and lint-free industrial apparel are described and illustrated in the 1958 edition of the above manufacturer's catalog and information book, just off the presses. On its pages is introduced a new group of acid-resistant 100% DuPont Dacron work clothes in blue and in grey, including shirts, pants, coveralls and laboratory costs. Also presented for the first time are new lint-free, acid-resistant 100% DuPont Orlon coveralls.

In addition, the catalog features a wide variety of work clothes in acid-resistant 100% DuPont Orlon, 100% Union Carbide Dynel, lint-free 100% Orlon, and wash-and-wear blends of Orlon and of Dacron. Resistance of the various fabrics to acids, caustics and other chemicals is fully documented with comprehensive laboratory reports relating to technical properties.

138/Circle on Readers' Service Card

### Germanium Rectifiers

*General Electric Co.*

Bulletin GEA-5773C, six pages, tells how to select and apply fan-cooled and blower-cooled germanium rectifiers. Tables, charts, line drawings, and photographs are included to tell the story of parallel and series operation, to indicate operating characteristics, to give dimensions, ratings and model numbers, and to offer information on special features of these component rectifiers.

139/Circle on Readers' Service Card

### Utrasonic Cleaning

*Curtiss-Wright Corp.*

The above firm has issued a four page, illustrated bulletin on its ultrasonic cleaning, washing and degreasing equipment. Advantages are given for this parts cleaning method, together with a chart listing the company line of washers and laboratory units, and specifications on their degreasing equipment.

140/Circle on Readers' Service Card

### Soak Cleaner

*MacDermid, Inc.*

Metex TS-40A, an effective non-etch soak cleaner originally designed for aluminum but also suitable for brass, copper, zinc, lead and ferrous metals is fully described in Technical Data Sheet No. 45, a two-page usage and instruction sheet.

141/Circle on Readers' Service Card

### Product Finishing Guide

*John Swift Chemical Co., Inc.*

The above firm has issued an eight page product finishing guide which lists standard references for the company's products for metal treating and finishing, including acid additives, blackening compounds, cleaners, tumbling compounds, lacquers, rust preventives and wetting agents.

142/Circle on Readers' Service Card

### Filter-Separator

*Richmond Engineering Co.*

A new file of data on the RECO 15-gpm filter-separator includes a check list of 49 industrial and commercial liquids which can be continuously cleaned by the unit.

Drawings show installation and dimensional data, attachments, and external details. Exploded views illustrate the construction of the filter-and-separator cartridge and its replacement sequence.

Also covered are: specifications, construction features, installation advice, effectiveness tests, and a synopsis of the theory of operation of the unit. An auxiliary table presents specifications on eight larger models.

143/Circle on Readers' Service Card

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**READER SERVICE DEPARTMENT**

**METAL FINISHING**

**PEOPLES TRUST BUILDING**

**WESTWOOD, NEW JERSEY**

January 1958

**READER SERVICE DEPARTMENT — METAL FINISHING**

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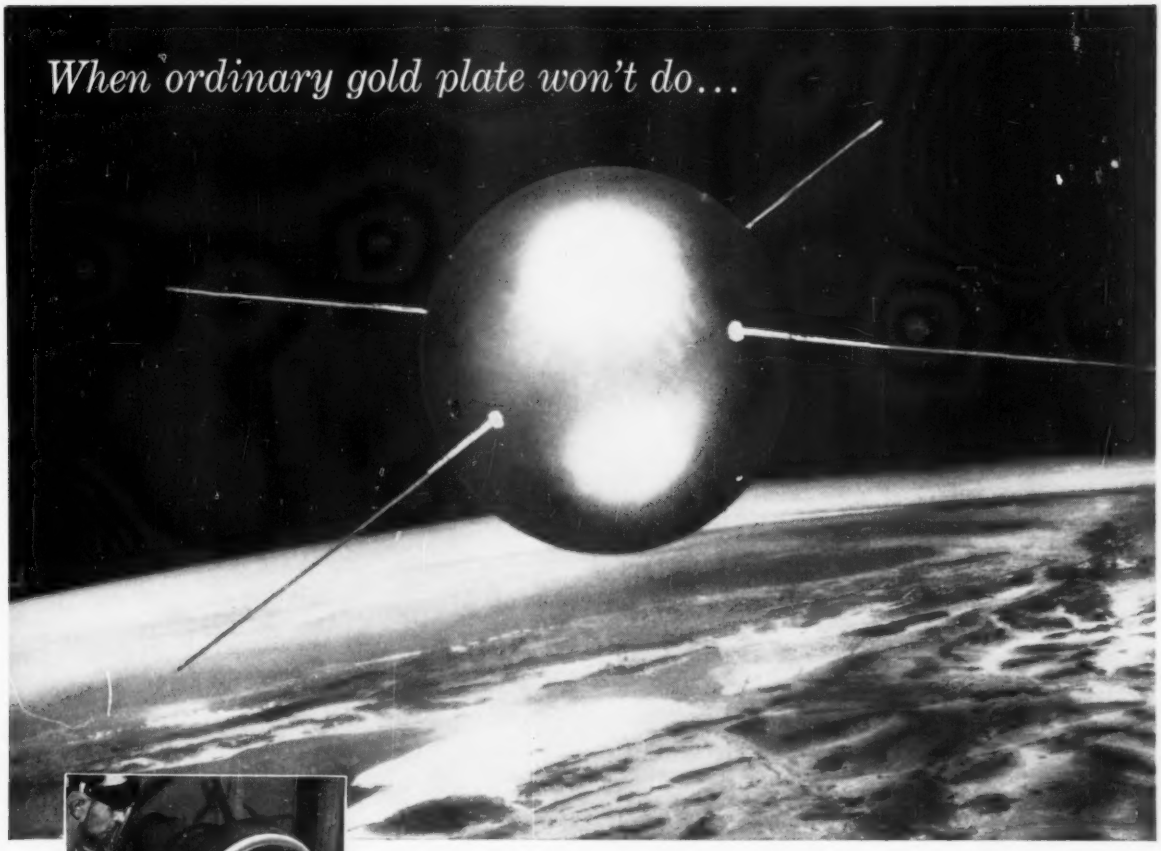
Company _____

Street _____

City _____ Zone _____ State _____

We manufacture (products) _____

*When ordinary gold plate won't do...*

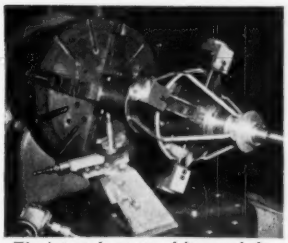




*Basic structure of the Satellite consists of two hemispheres which are spun to exact contour. They are made of Magnesium alloy.*



*An inner ring forms a pressure-tight circular chamber in the finished hemisphere. Cross-section view shows the resulting pressure cavity.*



*The internal structural frame of the Satellite is chiefly Magnesium tubing. This is also plated with Sel-Rex Bright Gold.*

# EARTH SATELLITE PLATED WITH SEL-REX BRIGHT GOLD

To provide maximum heat reflectivity and emissivity, The United States IGY Earth Satellites have been plated with Sel-Rex Bright Gold Process underneath their final coatings. This patented formulation was also used to plate most internal parts and instrument housings for temperature control.

The Earth Satellites will be launched from Patrick Air Force Base, Florida, sometime during the International Geophysical Year (IGY), which extends from July 1, 1957 through December 1958. The Satellites will transmit data to earth observation stations, from altitudes of 200-1400 miles, as they revolve in orbit around the earth at 18,000 miles per hour. This journey through space will subject the Satellites to temperatures ranging from $-5°C$ to $+45°C$, *every 90 minutes.* Selecting appropriate materials of construction required engineers' and scientists' solving problems *never even encountered before.*

The Earth Satellites have been made of Magnesium, and plated with Sel-Rex Bright Gold, by Brooks & Perkins, Inc., the country's leading independent producer and fabricator of Magnesium.

PRECIOUS METALS DIVISION

Sel-Rex **SEL-REX CORPORATION**

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Manufacturers of Exclusive Precious Metals Processes, Metallic Power Rectifiers, Airborne Power Equipment, Liquid Clarification Filters, Metal Finishing Equipment and Supplies.



## ARE YOU TROUBLED WITH CLOGGING PORES?

*Remove all organic and inert film from base metal pores with ANODEX!*

You get a bright, smut-free surface ideal for uniform bright deposits with MacDermid's ANODEX. It's the economical, easy-to-use reverse current cleaner for steel and copper that electrocleans better—and does it cheaper than other cleaners.

*All* surface contaminants are removed by ANODEX. No drag-in into plating solution . . . you save brightener costs when plating solution requires less frequent purification. ANODEX is easy to handle and control.

Send for free technical data, or ask a MacDermid representative about ANODEX.

**MacDermid**

...right to the Finish!

**MacDermid Incorporated**
**Waterbury, Conn., PLaza 4-5171**

**MacDermid Western**
**Ferndale, Detroit, Mich.**
**Lincoln 5-0064**

**MacDermid Pacific**
**Torrance, Calif.**
**DAvis 3-6292**